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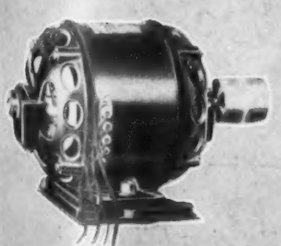

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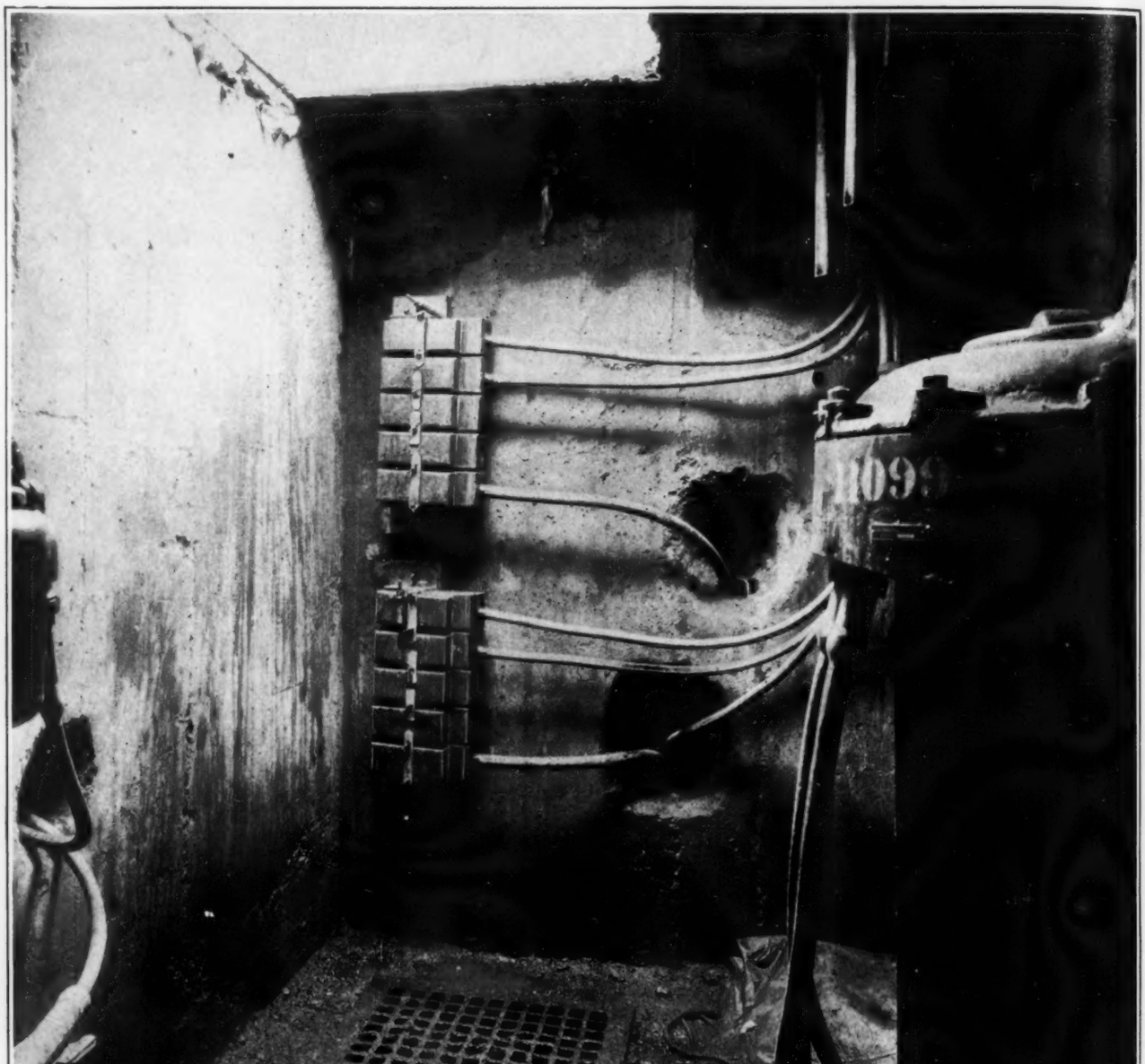

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# Electrical World

*The consolidation of Electrical World, Electrical Engineer and American Electrician*

Published by McGraw-Hill Company, Inc.

W. H. ONKEN, JR. Editor

HAROLD V. BOZELL Editor

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## Bankers Trade on Magic Name of Edison

THE news columns of the ELECTRICAL WORLD this week contain the announcement of the offering by a holding company of bankers' shares representing stock of a number of the most prominent Edison electric companies. If brokers or bankers care to purchase stock on the open market and to issue against this their own securities in the form of bankers' shares, that is their affair. It has been done before, but the debenture companies have not found it very profitable. In this case, however, the holding company showed excellent judgment in the choice of the stocks purchased and has not overlooked the advertising value of the magic name "Edison." The plan, however, did not emanate from the electrical industry. That is to say, the holding company is not the creature of the Edison companies named. As a matter of fact, none of the Edison companies knew anything about it. Nor could they have objected to the plan if they had.

The form of the announcement is misleading in that the holding company creates the impression that it has the backing of the Edison companies, which it has not, and owns shares of common stock in at least one company whose shares are not purchasable. The bankers are within their rights, however, and the immediate effect of any appreciable purchase by them of the shares of the Edison electric companies is to boost the value of the stock. The securities of electric light and power companies have been and are still very attractive to investors, and undoubtedly the holding company recognizes that and hopes to profit by it.

## The Story of the Public Utility *Can* Be Told!

THERE is a very striking demonstration of the general popular interest in the subject of public utilities in a recent experience of the president of the Association of National Advertisers. The head of this organization has been traveling about the country of late and is still on tour, talking to the "ad clubs" of important cities. It happens, however, that he is an electrical man, P. L. Thompson, publicity manager of the Western Electric Company, and keenly interested in interpreting the place of the public utility in the community. Therefore he has been taking as the subject of his addresses not a problem of advertising but a straightforward human-interest talk on "You and Your Public Utilities." And in almost every city where he has appeared before the advertising men he has also broadcasted his speech over the radio in the evening.

The extent of the popular response to this talk has been remarkable. A very large number of letters have been written by all classes of men in the radio audience commending the message and asking advice in relation to local utility problems. A great many utility men who happened to "listen in" have asked for copies of the speech. But the significant point is that this story can actually be told this way. For if a manufacturer can obtain such audiences about the country and broadcast this message into the countless homes that radio reaches, surely the door is equally open to the utility executive.

Any ill will that the central station may suffer today comes from lack of interpretation. The people do not fully understand why private operation is better economically than political operation, why the utility needs and deserves the personal support of the public in the community it serves. But they would be glad to know, and once the matter is made clear and kept clear they will act fairly because their attitude will be appreciative and friendly. The responsibility for interpreting the company to its public rests squarely on the executive. He must tell his story to the people, and Mr. Thompson's experience shows that it can be done with little difficulty by one who goes about it properly.

## Oil Breakers or System Damping

THE clash of opinions of operators and manufacturers about oil breakers recently witnessed at the Birmingham meeting of the American Institute of Electrical Engineers is a natural result of the very rapid growth of the industry and the very great increase in power concentrations. The fundamental question is, what is the maximum rating of a breaker that can be expected to operate satisfactorily on the different voltages used? Once this question is answered, system layouts may be made to limit energy concentrations to this value. And while dealing with concentrations of a million and a half kilovolt-amperes today it must be kept in mind that if existing methods of system layout are continued, the concentrations will be four or five million kva. in a few years.

Most interested parties would agree that attempting to break energy concentrations of five million kva. in a breaker is fundamentally undesirable both from an operating and a mechanism standpoint and that, judged in the light of present knowledge and practices, it is essential to limit disturbances to smaller kva. values. And then, again, the operators labor under some misconceptions, for they have service requirements only in mind. Service is always the governing element, and from this standpoint some breakers should be able to operate without any time interval in their duty cycles and without limitation as to the number of duty cycles. But if even a million kva. was involved, few operators would attempt to close breakers repeatedly, as the shock to the system would be extremely severe. Moreover, few operators would pay the price required to secure breakers designed for such duty.

But feeder breakers do and can handle unit service

requirements, and multiple-feed points to all important loads permit the use of these reclosing feeder breakers involving small energy concentrations. Thus the main system breakers, owing to multiple feeding, can use time-element duty cycles without affecting service materially. These breakers can be purchased at a price commensurate with the restricted duty.

Modern breakers are a credit to their makers and in view of the very rapid increase in duty demands are surprisingly satisfactory. Certain ill-advised requirements of system operation should not be predicated on making oil breakers bear the brunt of the duty of breaking circuits involving enormous amounts of short-circuit kva. The real problem is to determine the maximum breaker duty that will be needed when all elements have been considered, and then to lay out systems so that this is the duty that the breakers will confront and so that this duty can be satisfactorily met while rendering service of the highest quality.

## Detecting Defective Insulators

IN THE operation of high-tension transmission lines it is commonly necessary to keep them under service tension continuously. There may be cases in which the lines are discharged over a holiday, but ordinarily a line goes into charge like a ship into commission, only to come out for a breakdown. The consequence of this sustained operation is that inspection tests have to be made during service. The testing of the suspension insulators calls for special attention, in order that one or more defective insulators in a string may be removed and replaced before a total breakdown can develop.

At least two devices for insulator testing under charge have already been produced and have been described in these columns. In last week's issue C. E. Bennett gave a good account of another instrument for the purpose, which he names an "aislometer," a word derived from the Spanish. This instrument is a very suitable form of electroscope, capable of being held at the end of an insulating pole, so that its terminals may be brought into contact with the terminals of the insulator to be tested. The behavior of the movable element can be observed by the operator through a window in the instrument, and thus the test of an insulator can be made with very little delay. If a disk becomes defective, the voltage across it tends to become abnormally low and the electroscope fails to give a proper indication when brought into contact with the disk terminals.

An instrument of this kind calls for great care in design. If the moving element is too light, it is apt to be frail and easily deformed. If, on the other hand, it is too heavy, its considerable inertia and pivot friction induce troubles of a different kind but just as unwelcome. An instrument of this type, before proving succesful in practice, would probably call for many minor modifications and readjustments. It is hardly to be hoped that the first model would meet all requirements so well as to need no improvements. An electroscope such as this has the advantage that, if properly constructed, no short circuit or rupture of insulation will occur in the working parts. A flashover may occur over the terminals outside the instrument, but this ought not to injure the mechanism within the box.

A long transmission line necessarily embodies in its structure a large number of insulators. It is a great source of satisfaction to those in charge of such lines to know that each and all of these insulators can be tested electrically at regular intervals without throwing the line out of service.

## What the Appliance Load Really Means to the Central Station

IN THE eighth article of the ELECTRICAL WORLD'S series "Who Sells Electrical Appliances?" on page 774 of this issue, a central-station manager is reported as making the statement that "the use of appliances has been the greatest single cause of a very noticeable decrease in the number of high-bill complaints." Amplifying his remarks, he observed, as quoted in the article, that as residential bills have grown larger because of greater use of household electrical devices, customers have been less inclined to question the accuracy of the meter or charge the company with questionable practices. They appreciate that through their electrical appliances they are receiving a fuller service, and they are willing to pay for it.

How far this influence has already extended it is impossible to say, but the results have been very apparent in fewer complaints and better public relations. These facts point the way to the ultimate solution of the problem of making the residential customer profitable and at the same time making him a better friend of the central-station company. If the present comparatively meager use of electrical conveniences in the home can bring about such an improved condition, a more intensive cultivation of the domestic-appliance business will surely result in a residential load exceeding all but the most sanguine hopes of central-station men today.

## Primary Batteries That Breathe

APPARENTLY inventors have not given up hope of being able to obtain a greater part than heretofore of the energy available in the materials of the primary battery. The most serious questions in this direction, in the common forms of battery, are the necessity of renewing the depolarizing agent and the failure, in the short life, to use completely the active materials. Comment was recently made in this column on the Féry battery, produced in France, in which the oxygen of the air is used as a depolarizing agent. Recent French journals not only give more complete information as to the Féry battery, but they reveal that at the recent electrical exhibition at the Grand Palais, Paris, no less than three types of battery using this principle were shown, and that one of them is made and offered by the Société le Carbone, one of the oldest manufacturers of primary batteries in France. These are significant facts, and the data given indicate notable improvements for certain classes of service over the performance of other types of battery.

All of these cells are of the Leclanché type, using carbon, zinc and ammonium chloride. The distinguishing feature is the exposing of a large portion of the surface of the carbon to the air. In the cell of the Société le Carbone the carbon, in granulated and very porous form, is inclosed in a sack, apparently of asbestos, which is electrically conducting and permeable to gas, but not permeable to liquids. The zinc is in the

form of a flat plate completely submerged. In service chloride of zinc covers the zinc electrode, protecting it from attack by the ammonia. The hydrogen of polarization produced at the positive electrode combines at the membrane with the oxygen in the granulated carbon, forming water, in which the ammonia is dissolved. This causes a lowering of pressure in the carbon, leading to a further absorption or "breathing" of oxygen from the air and at the same time tending to hold the ammonia gas at the membrane. It is stated further that this depolarizing action causes a secondary emf. which is added to the principal emf., resulting in a more effective usage of the theoretical value of the zinc and a partial regeneration of the ammonium chloride.

The limiting feature of the cell is its rate of output. This is determined by the rate at which oxygen is absorbed into the carbon electrode. This rate can be increased by increasing the area of exposed carbon. The normal discharge rates in cells of the usual size vary from 0.1 amp. to 1.5 amp., according to the design. Within the discharge rate the reactions take place with great regularity, and at steady load the cell is characterized by very constant voltage. The internal resistance is also very low. The principal claim of the cell over other familiar forms, however, is its greater capacity. For both the wet and dry forms it is stated that the capacity for equal volume is twice that of the usual cell with manganese dioxide as depolarizer, and that the shelf life of the dry cell is much longer owing to the impermeability of the positive electrode to the liquid electrolyte. The cell therefore would appear to have very great advantages for all classes of service involving moderate rates of discharge, as, for example, the plate circuits of vacuum tubes, cable testing and the like.

## Opportunities for and Advantages of Floodlighting

A FEW years ago floodlighting of buildings, monuments and other objects showed promise of developing considerable momentum. The high tide reached during the war by the floodlighting of industrial plants ebbed, as it was expected to do, but this might have been counterbalanced by growth in other fields. To bring about the use of floodlighting demands, perhaps, more individual effort in each specific case than store lighting, for example. However, it has a peculiar value aside from revenue. It is novel and conspicuous, thereby silently advertising to the public the potentiality of artificial light. Every town has some opportunity for floodlighting, and every city has many. These are easily discovered by the wide-awake central-station man who has an eye for business opportunities.

During the war the protective value of floodlighting industries, railroad yards and other vital spots was proved to be far in excess of its cost. Much of this need has vanished, but as long as watchmen are needed there still remains an argument of this nature. However, there are many other places for floodlighting. If one looks over any city with an eye for possibilities, he will see many. Here may be a building which could be completely flooded. There may be one whose upper stories or battlement could advantageously be made conspicuous. Perhaps the opening of a new building offers a good opportunity. The parks abound with monuments and memorials. A flag or ornament may be rescued from darkness by only one or two beams of light. Today floodlighting equipment is standard and adequate where a few years ago it was in an evolutionary stage. Colored glass accessories now make it possible even to introduce colored rays. The results of floodlighting are interesting, even fascinating, and are often tinged with an air of mystery. They pay dividends beyond mere central-station revenue.

## Opinions on High-Voltage Arresters

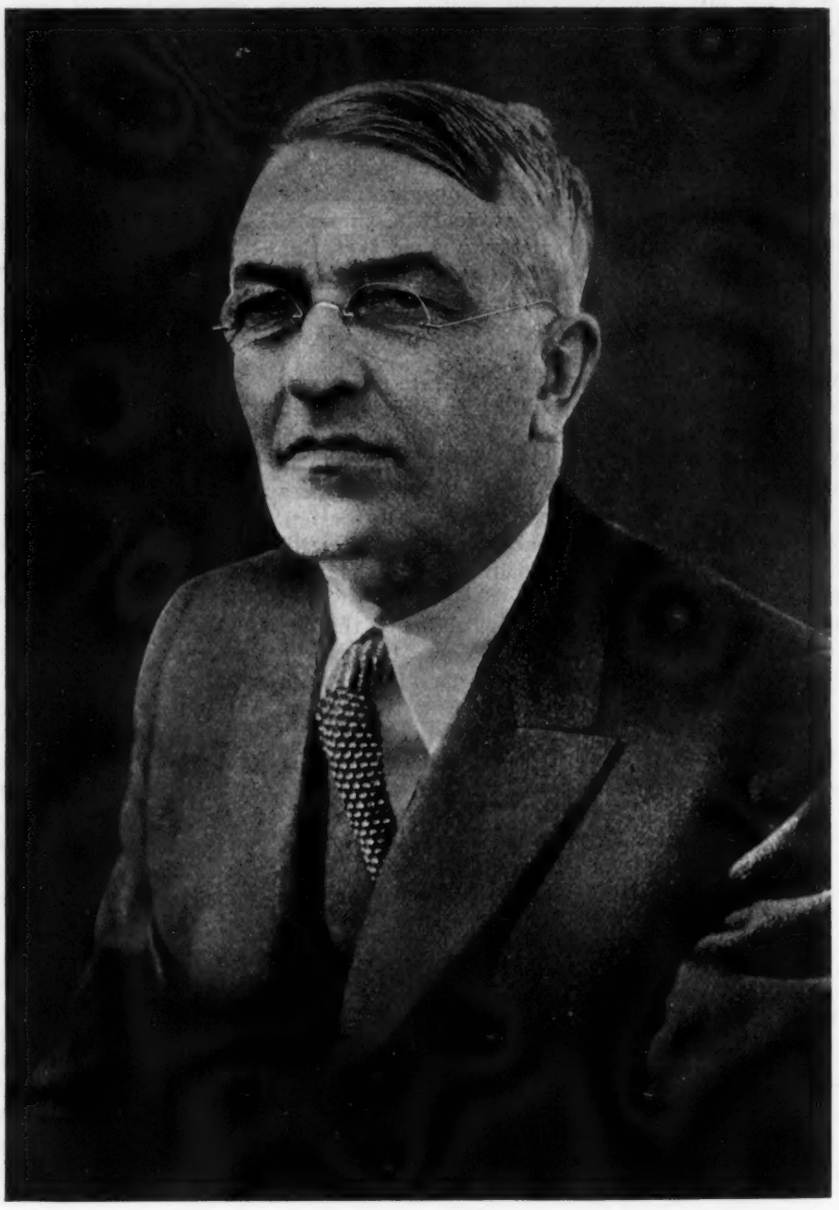
THE papers on lightning arresters at the Birmingham meeting of the A. I. E. E. added to existing knowledge and in addition indicated the existence of a situation which should be studied carefully. The economic value of lightning arresters for systems using voltages up to 22 kv. has been proved by "grand average" studies made on several properties, and the tests made on the Duquesne Light Company's system showed that arresters function satisfactorily on these systems. But there has been a wave of conviction sweeping the ranks of operating engineers to the effect that arresters are not an asset for systems using 66 kv. and above, and several properties have discontinued their use for lines operating at these voltages. Thus a very vital economic decision affecting service reliability has been made largely on the basis of guesswork. For even the specialists have not presented positive data or really definite opinions to aid the situation.

Fundamentally the use of arresters should be based on economics and a concrete knowledge of the added service reliability obtained by their employment on high-voltage systems. Before definite decisions are made it is necessary that true information be obtained in regard to the exact nature of lightning effects on transmission systems. When specialists debate about energy content, surge frequency, wave front, wave shape and wave oscillations it would seem logical to make field investigations over a sufficient period of time to obtain broad data. That some real field investigations are being made was indicated recently in these columns in the article by Dr. H. Norinder, a subsequent article by E. E. F. Creighton, and by editorial comment (see ELECTRICAL WORLD Feb. 2, March 15 and March 29, 1924). But, as pointed out in these earlier discussions, until conclusive information is available as to the exact nature of lightning disturbances on transmission lines, these debates as to the use or non-use of arresters of any type on high-voltage systems seem profitless and a waste of words.

Instruments are now available with which to get accurate data. With such equipment as the oscillograph, the klydonograph and the cathode-ray oscillograph a group of specialists could make these field investigations for the benefit of the entire industry. There naturally arises from this situation the suggestion of more extensive co-operative research by operating companies and manufacturers in order to carry on some comprehensive co-operative studies. After the fundamental data are available the different manufacturers can produce devices to meet given requirements. But it is doubtful policy to require them to shoulder the entire fundamental research expenses of primary importance to the operating companies.

# Charles Kelly King

*An executive whose knowledge of the electric railway field coupled with his skill and vision as an organizer has developed one of the outstanding manufacturing companies of the industry and contributed much to progress.*

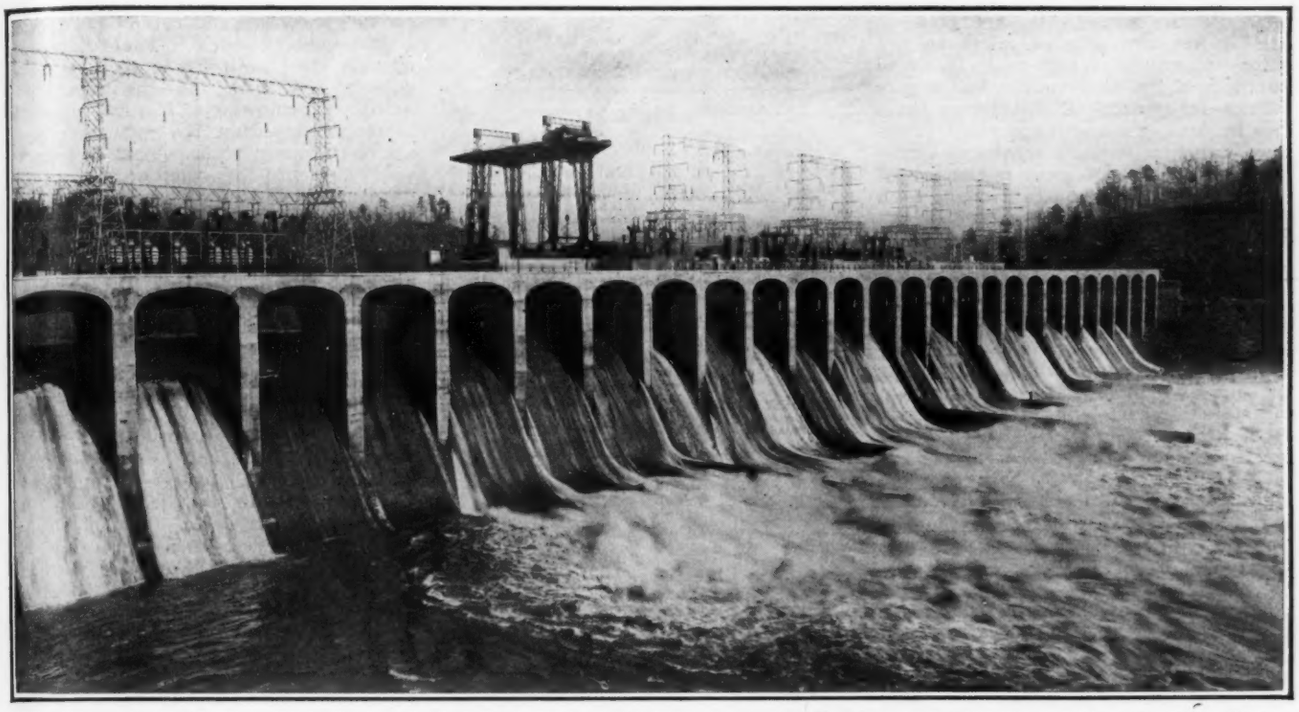


IT IS not uncommon for a manufacturing executive with an expert knowledge of a product to be successful in creating a market in a new field. But such a man usually finds his chief interest in the development of the product rather than in the upbuilding of the industry it serves. Analysis of conspicuous instances of spectacular success in this broader service to the electrical market usually discovers this industry-interest as an underlying motive and ideal. Such is signally the case in the career of Charles K. King, vice-president and general manager of the Ohio Brass Company. Mr. King has ever been an electric railway man first and foremost. His interest in brass and porcelain products has come second.

Charles King was born in Calais, Me., in 1867, and after the completion of his schooling and a special business course at Johns Hopkins he went to work in the electric railway department of the Northwest Thomson-Houston Company at St. Paul. He was engaged in the construction of trolley systems and had charge of installations in Helena and Great Falls, Mont. From there he went to the Electrical Supply Company, later the Ansonia Electrical Company, of Chicago, where he was sales engineer, designing and selling electric railway materials. Then in 1893 he moved to Mansfield, Ohio, and associated himself with the Ohio Brass Company, then a small brass foundry five years old. He devoted his energies immediately to the designing of a line of trolley materials which marked the entry of this company into the electrical field.

Mr. King and his associates saw a great future in the electrical industry. In 1910 the plant of the Akron High-Potential Porcelain Company was purchased and reorganized as the Ohio Insulator Company, which has been operated as a subsidiary of the Ohio Brass Company. Under Mr. King's leadership and direction the business of the Ohio Brass Company has grown from a foundry with thirty hands employed to a manufacturing organization numbering more than two thousand.

Mr. King has shown his greatest skill and success as an organizer. He is a man of broad vision, yet a conservative, substantial builder of industry with high ideals of creative service. He has consistently refused to market any product until it has been tried out in use. In other words, his test has ever been the interest of the industry at large rather than business expediency or commercial advantage. And on the foundation of this high principle has been erected one of the outstanding manufacturing institutions of the electrical world.



MITCHELL DAM DEVELOPMENT OF THE ALABAMA POWER COMPANY, BUILT WITH POWER HOUSE IN CENTER, TO ALLOW MAXIMUM USE OF BACK-WATER SUPPRESSORS. THIS PLANT WAS ONE OF THE TWO VISITED BY THE A. I. E. E. CONVENTION DELEGATES

# A. I. E. E. Spring Convention Discusses Three Main Topics

## Hydro-Electric Developments, Relay and Lightning-Arrester Protection of Circuits and Experiences with Circuit Breakers of Large Rupturing Capacity Arouse Much Interest at Birmingham Meeting—Other Technical Subjects

FOLLOWING its present program of four conventions annually, the American Institute of Electrical Engineers held its third spring convention at Birmingham, Ala., last week, and it proved to be a most successful meeting. More than three hundred and fifty registered at the convention—including some ladies, who were hospitably entertained in true Southern style—and the excellence of the local arrangements under the direction of W. E. Mitchell and his committee contributed materially both to the success of the meeting and the pleasure of the attendants. Seven technical sessions on various subjects and one general session on water-power developments were held during the week. Unfortunately rain prevented the "old-fashioned Southern barbecue" which had been planned for Wednesday evening, but other excellent entertainment, including typically Southern music by negro singers, was substituted. More than one hundred and twenty-five enjoyed the day's trip on Thursday to the generating station of the Alabama Power Company at Lock 12 on the Coosa River and then down the river 14 miles to the power house at Mitchell Dam.

During the convention a resolution suggested by Percy H. Thomas, consulting engineer, New York, was passed advising the board of directors that the members of the convention affirmed the principle that water powers should be developed or disposed of only under the conditions outlined by and according to the provisions of the federal water-power act.

### Hydro-Electric Equipment Discussed

THE engineering features of hydro-electric developments were the subject of the first session of the convention, Monday afternoon. A résumé of hydro-electric practices and equipment in the South was given in a paper by O. G. Thurlow and S. A. Sirnit, both of the Alabama Power Company. The paper pointed out that the absence of snow and the general topography of this part of the country produce water conditions such that wide variations in flow occur. The annual precipitation in the South is 40 in. to 80 in., with a ratio of rainfall to run-off varying from three to two in the headwaters to four to one or two to one in the foothills, depending upon dry or wet seasonal conditions respectively.

Most of the rivers yield only run-of-river power, with very little primary and a large amount of secondary power, and require supplementary steam plants or storage basins for the full utilization of their possibilities. Most of the developments are low-head, and the use of heavy-gravity dams is essential because of floodwater demands. The Mitchell Dam with the Thurlow backwater suppressor has also been developed to gain a more nearly complete utilization of heads during floodwater conditions. A gradual development of interconnection has come about between seven companies until transmission lines cover a territory 800 miles long and 300 miles wide. Power is relayed from system to system as conditions demand, and the interconnections have proved valuable in times of storm or other emergency conditions. The table on page 762 shows the systems and the developments now in operation on the systems, which have a total combined capacity of 1,100,900 kw.

#### PACIFIC COAST PRACTICE

A paper treating of the hydro-electric practices and equipment on the Pacific Coast was presented by S. Barfoed, consulting engineer. In the paper the topographical features on the Coast were described and data given on precipitations and run-off in the several

sections. In general, storage is used, and it has proved economical to use steam plants to carry peak loads to supplement the water power and to give service insurance. A distinctive practice in dam construction devised to reduce construction costs where excess flood waters do not occur is the use of multiple-arch and constant-angle arch dams. A thorough treatment of surge tanks, conduits and pressure pipes was given in the paper, which also described the construction features of power houses and transmission lines. The author stated that long pipe lines contain moving water columns of thousands of tons weight which must never get out of control. If control is lost, disaster is swift and certain. Aside from the control obtained through the governor, stop gates or valves are placed in long lines at both top and bottom. For short lines and single-unit plants the valve at the bottom is sometimes omitted. In the older plants the gates at the top were simple devices often made of wood; in later plants valves have been introduced directly in the pipe line, just after leaving the forebay or surgetank. Both slide valves and butterfly valves are used, and the latter seem to be gaining in favor and so far have given very good results. The butterfly valve is sufficiently tight when carefully made, and the body of its closing disk can be made of efficient form with respect to the flowing water. At the power-house end slide valves, butterfly valves and plunger valves have been used with uniformly good results, with the exception of the control for the plunger valve, which has not been positive and powerful to the degree required by the high pressures and long lines used on the Western Coast.

### MITCHELL DAM AND NIAGARA FALLS

In a paper on recent developments in hydro-electric equipment W. M. White, Allis-Chalmers Manufacturing Company, described the Mitchell Dam installation as exemplifying in some details the latest practices with heads of the order of 70 ft. Even though the waterwheels, located at tailwater level, are considerably below the generator level, wheels of "normal rational design" were used, each having a single runner of cast iron, 130 in. in diameter weighing 100,000 lb. Their capacity is 24,000 hp. each. Mr. White also discussed the new Niagara Falls units, 70,000 hp. each, the largest so far installed. The water for these units is conducted from the forebay at the top of the cliff through butterfly valves connected to concrete-lined tunnels driven through the solid rock. At the lower end a plate-steel section of penstock is imbedded in the tunnel and 21-ft. 6-in. diameter Johnson-type valves are used for shutting off the water from the turbines. The casings on two of the turbines are of cast steel made in sections and bolted together. The third unit is of the circular-section plate-steel type riveted to a cast-steel speed ring made in sections. The turbines operate under 213 ft. effective head at 107 r.p.m.

The three units will be equipped with the concentric type of draft-tube regainer of the hydraucone or Moody spreading type. The principal features of the Allis-Chalmers hydraulic turbine are a cast-steel runner made in one piece approximately 180 in. in diameter, weighing about 100,000 lb.; a main shaft 34 in. in diameter of forged steel, hollow-bored, provided with forged flanges on both the upper and lower end, the runner being bolted to the lower flange with steel-fitted bolts, and a main turbine guide bearing of the adjustable, lignum-vitæ type, lubricated with water drawn from a settling reservoir at the top of the cliff. The guide bearing is built with four adjustable shoes so that they may be taken up in any direction to compensate for wear. The guide vanes are of cast steel with upper and lower stems cast integral. The upper stems extend through bronze bushings in the cover plate, where they are connected to the shifting ring by means of levers and breaking links. These breaking links are so designed that they will give way either in tension or compression when some obstruction prevents the opening or closing of the guide vanes.

POWER GENERATING STATIONS OF THE POWER COMPANIES IN THE SOUTHEASTERN SECTION

**Alabama Power Company**

| Hydro-Electric Stations, Kw. | | Steam-Electric Stations, Kw. | |
|---|---|---|---|
| Lock 12 | 81,000 | Warrior | 70,000 |
| Mitchel Dam. | 60,000 | Gadsden | 10,000 |
| | | Birmingham | 8,000 |
| | | Montgomery | 5,000 |
| | | Sheffield* | 60,000 |
| Total | 141,000 | Total | 153,000 |

**Tennessee Power Company**

| | | | |
|---|---|---|---|
| Hales Bar | 43,300 | Parksville | 13,000 |
| Parksville | 18,650 | Nashville | 29,600 |
| Great Falls | 7,800 | Knoxville | 6,250 |
| Ocoee No. 2. | 18,750 | Hales Bar† | 20,000 |
| Total | 88,500 | Total | 68,850 |

**Georgia Railway & Power Company**

| | | | |
|---|---|---|---|
| Tallulah Falls | 72,000 | Atlanta, Butler St. | 7,800 |
| Morgan Falls | 21,000 | Atlanta, Davis St. | 11,750 |
| Tulago | 50,000 | | |
| Dunlap | 2,200 | | |
| Chestater | 900 | | |
| Total | 146,100 | Total | 19,550 |

**Columbus Electric & Power Company**

| | | | |
|---|---|---|---|
| Goat Rock | 17,500 | Columbus, Ga. | 9,000 |
| North Highland | 6,900 | | |
| Total | 24,400 | Total | 9,000 |

**Central of Georgia Power Company**

| | | | |
|---|---|---|---|
| Lloyd Shoals. | 18,000 | Macon | 3,000 |

**Southern Power Company**

| | | | |
|---|---|---|---|
| Bridgewater | 20,000 | Eno | 25,000 |
| Lookout | 18,000 | Greensboro | 6,800 |
| Catawba | 4,800 | Mount Holly. | 36,800 |
| Fishing Creek | 30,000 | Greenville | 6,800 |
| Mountain Island | 60,000 | | |
| Great Falls | 24,000 | | |
| Rocky Creek. | 24,000 | | |
| Wateree | 56,000 | | |
| Dearborn | 45,000 | | |
| Ninety-nine Islands | 18,000 | | |
| Total | 299,800 | Total | 75,400 |

**Carolina Power & Light Company**

| | | | |
|---|---|---|---|
| Buckhorn | 2,900 | Florence | 1,500 |
| Blewett | 30,000 | Raleigh | 3,720 |
| | | Goldsboro | 1,200 |
| | | Cape Fear | 15,000 |
| Total | 32,900 | Total | 21,420 |
| Total hydro-electric | 750,700 | Total steam-electric | 350,220 |

*Leased from United States government.
†June, 1924.

The generators are rated 65,000 kva., 13,200 volts, 25-cycle. The rotors are of cast steel built up in sections with pole pieces bolted to the rim. An auxiliary generator of 650 kw. capacity is mounted within the generator just above the main rotor. This is to provide current for the auxiliary apparatus such as oil pumps, motor-generator sets, cranes, lights, etc. The entire rotating weight of more than 700,000 lb. is carried on the Kingsbury thrust bearing.

At the upper end of the penstock, instead of the customary type of square-head gate, three 23-ft. 6-in. diameter butterfly valves are used to shut off the water. They have cast-iron housings made in sections and cast-steel and piate-steel wickets turning on forged-steel pivots. The axes of the butterfly valves are set vertically, the operating mechanism being installed on the deck above the water level.

The last paper on the program, by F. H. Rogers, of William H. Cramp & Sons, discussed acceptance tests of hydro-electric plants. The author dealt with the various values necessary to measure to insure the efficiency of units, and also with the measuring equipment and methods, and then showed how to use the test data to operate plants most economically. The criterion developed by the analysis was that the total load should be so divided between units as to obtain equal values of the first derivatives of the power-discharge curve of each unit.

### DISCUSSION OF PAPERS

In the discussion of the papers W. S. Lee, Southern Power Company, stated that distances from manufacturers or materials influenced the choice of dams, but that for the South it was best to use heavy-gravity dams. He said the multiple-arch dam was utterly unsuitable and that, in his opinion, the concrete-core-wall earth dam was a mistake and it would be better to use a solid earth dam where such dams are built at all. P. M. Downing, Pacific Gas & Electric Company, said that multiple-arch dams are used on the Pacific Coast only where water conditions and construction conditions are favorable. He added that steam plants are most economical for handling peak loads even where the daily load factor is 80 per cent and the yearly load factor 65 per cent, if the distances are great and the investment in hydro-electric developments is high.

George A. Orrok, consulting engineer, New York, said that cavitation occurred in waterwheels both in Europe and America and the art must be developed before this action could be eliminated. W. M. White said that cavitation resulted because high specific speeds were used to accommodate the generator speed conditions and that a total economic minimum cost of a unit dictated such speeds that cavitation might occur. He stated that cavitation was not a serious matter and that if a hole pierced the runner further action ceased and little leakage occurred. W. S. Lee corroborated Mr. White in the last statement and added that cavitation always occurred on the discharge side. P. M. Downing asserted that he had noticed a pitting on the

face of the impulse-wheel buckets which was similar to the cavitation effect on wheels. W. E. Mitchell, Alabama Power Company, said it was impossible to prevent cavitation if the load and speed of units were variable for a given installation. F. H. Rogers, at the request of Mr. Mitchell and others, elaborated upon the method proposed for securing maximum efficiency in the operation of hydro-electric installations.

## Lightning Arresters and Relays

ON TUESDAY morning the general subject of arresters was discussed. W. F. Young, Duquesne Light Company, Pittsburgh, presented the results of tests on 22-kv. and 4-kv. arresters made on the Duquesne Light Company system. It was desired to get data in regard to speed of discharge, ability to stop dynamic current and ability to operate repeatedly. The tests were made on several types of arresters by a method and with equipment described in the paper. The author gave the following brief description of the 22-kv. arresters tested:

1. Electrolytic or aluminum cell, ninety-one trays, laboratory sphere gap.
2. Carbon disk pile, four columns of disks, sphere gap.
3. Oxide film, ninety-six cells, sphere gap.
4. Series water resistance, sphere gap and horn gap.
5. Multiple horn gap with shunt resistance; fuse ahead of arrester.
6. Multiple gap, series resistance; circuit-breaking device to increase gap.
7. Horn gap with series resistance, carborundum covered rod to extend arc.
8. Horn gap with series resistance.

### Results with 22-Kv. Arresters

The results attained were summarized as follows:

Arrester No. 1 showed highest speed and highest discharge capacity, protected insulator and stopped flow of dynamic current.

Arrester No. 2 showed second highest speed and third highest discharge capacity of valve-type arresters, protected insulator and stopped flow of dynamic current.

Arrester No. 3 showed second highest discharge capacity and third highest speed of valve-type arresters, stopped dynamic current and protected insulator each time when surge impedance was in circuit, but only 50 per cent of time when there was no surge impedance in circuit.

Arrester No. 4 showed low speed of discharge and intermediate discharge capacity on surges at 100-kv. potential; interrupted dynamic current; bushing of arrester flashed over on 150-kv. surges, emphasizing lack of speed in discharging.

Arrester No. 5 showed high discharge capacity and protected insulator perfectly, but would not interrupt dynamic current without blowing fuse, thus making it inoperative for further surges. The discharge current went across gaps to ground in the static tests. In the dynamic tests this resulted in short-circuit.

Arrester No. 6 showed intermediate discharge capacity and interrupted dynamic current. Some of the series resistors were wholly or partly flashed over on each test with surge impedance. The insulator was, however, perfectly protected when there was surge impedance in the circuit, but flashed over each time when the surge impedance was removed.

Arrester No. 7 showed low discharge capacity, failed to protect insulator and would not interrupt dynamic current.

Arrester No. 8 showed low discharge capacity, protected insulator part of time but would not interrupt dynamic current.

Of the lightning arresters tested, Arrester No. 1, Mr. Young said, is the most satisfactory for removing surges from lines and equipment. It has a very high speed of discharge and a heavy discharge capacity.

Arresters No. 2 and No. 3 are of about equal value as protective devices, No. 2 having a greater speed of discharge and No. 3 having the heavier discharge capacity, provided the same connections are used on both arresters. Neither of these arresters affords the same quality of protection as No. 1.

Arrester No. 6 was the only other one to meet the requirements originally set up. This lightning arrester has a comparatively low discharge capacity with low values of surge impedance, and its inability to protect the insulator in some cases was probably due to this characteristic.

Of the other arresters tested, each failed in some respect to meet the requirements set forth. Arrester No. 4 has a low speed of discharge which allows flashover to occur at a weak point in the insulation. This arrester has a fair discharge capacity and would perhaps be satisfactory on surges of sloping wave front. The cause of the slowness of the arrester discharge is thought to be the series resistance. Arrester No. 5 shows very desirable discharge characteristics but cannot be satisfactory so long as the fuse operates to clear the dynamic current, leaving the arrester inoperative on further surges. Arresters No. 7 and No. 8 are felt to be unsatisfactory because of their failure to protect the insulation and to clear dynamic current.

### Description of 4-Kv. Arresters

A brief description of the arresters was included in the paper as follows:

1. Carbon-disk pile, single column of disks, inclosed gap.
2. Multiple gap, two shunting resistance rods.
3. Oxide film, twenty cells to ground, sphere gap.
4. Multiple gap, series resistance, whole arrester incased in porcelain.
5. Series water resistance, sphere gap.
6. Porcelain bushing over iron pipe, horn gap between line and ground, no series resistance.
7. Multiple gap, series resistance, circuit-breaking device to increase gap.
8. Multiple gap and series resistance rod incased in porcelain.

The results obtained from the tests on the 4-kv. arresters were as follows:

Arrester No. 1 showed rapid speed and high discharge capacity. This arrester interrupted dynamic current very satisfactorily.

Arrester No. 2 showed high speed of discharge, intermediate discharge rate, and interrupted dynamic current satisfactorily.

Arrester No. 3 showed intermediate speed of discharge, a fair capacity of discharge, and interrupted dynamic current satisfactorily.

Arrester No. 4 showed low speed and discharge capacity but interrupted dynamic current satisfactorily.

Arrester No. 5 showed low speed and discharge rate. The dynamic tests on this arrester were not completed.

Arrester No. 6 showed high discharge rate but was incapable of interrupting dynamic current.

Arrester No. 7 showed intermediate discharge capacity but was incapable of interrupting dynamic current.

Arrester No. 8 showed intermediate speed and capacity of discharge. The dynamic tests were not completed on this arrester. Numerous operations of the arresters were performed very successfully and the manner in which the surge was cleared indicated that satisfactory results would probably be obtained in service with any of the types that withstood the test.

### Southern California Experience

A second paper, by E. R. Stauffacher, Southern California Edison Company, dealt with lightning-arrester experience in California. It has become the practice to install arresters on each of the overhead lines radiating from a substation or generating plant and not to install arresters on the buses. All arresters are installed outdoors and are used only on lines up to and including 60 kv. On the 150-kv. and 220-kv. lines no arresters are used. Operating records showed that troubles on the system known to have resulted from lightning during 1923 were as follows:

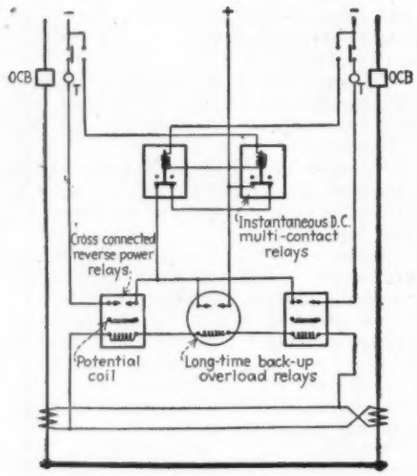
| Potential of line, kv. | 10 | 15 | 30 | 60 | 150 | 220 |
|---|---|---|---|---|---|---|
| Troubles | 98 | 39 | 8 | 14 | 1 | 0 |

The 30-kv. lines constitute a much smaller proportion of the system than the 60-kv. lines. It has not been the general practice to use arresters to protect distribution transformers, but the use of arresters on lines below 150 kv. has proved advisable and been justified as an insurance against damage to equipment or unnecessary interruptions to service.

### Economics of Arresters

Lightning arresters were treated from an economic standpoint in a paper by A. L. Atherton, Westinghouse Electric & Manufacturing Company. All factors connected with arrester uses were given assumed dollar values and a resulting group of curves was presented which indicated the fields where it would be economical to install different types of arresters. These studies were based on assumptions and gave only results based on these assumptions and average conditions. The method of attack, however, is generally applicable to the problem.

Another paper on arrester designs and operation was presented by C. E. Bennett, Georgia Railway & Power Company. The electrolyte-tube type




IMPROVED 66-KV. LINE PROTECTION FOR DUQUESNE RING

To operate the Duquesne ring with one or more single-line sections in the circuit without danger of dropping these sections when faults occur on other sections, a set of overload relays is added, as shown above. These relays are automatically thrown into service when one line of a pair is removed from the circuit. They then give overload protection on the remaining line, and their time is set high enough to be selective with the remaining fast-time balanced relays. This will prevent the unnecessary opening of all good single-line sections, when faults occur on the other paired sections, at the same time giving the single-line sections ample protection for themselves.

This arrangement also provides an adequate interlocking system capable of accurate time setting and one which, should it fail to function, cannot leave any lines without protection. This is accomplished by the same relays referred to above. The time delay is secured through the action of the long-time back-up alternating-current overload induction relay, which is automatically thrown into service as stated. This relay starts to trip out the good line, but the bad line clears at the other end before the long-time overload relay can close its contacts.

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was described and its discharge characteristics were explained. The author said that it was a high-resistance arrester and slow in action as compared with other types, but that it could be set for 25 per cent excess voltage and therefore would start to discharge at a low rise in potential. It was also maintained that close setting permitted better drainage. A variation of this type of arrester was shown which consisted of a string of small units to be hung as a line. Each unit was sealed and half filled with electrolyte with a pierced partition in the center so that interruption of dynamic currents resulted from the passage of the current through the small pencils of liquid in the partition.

### OPERATING EXPERIENCES WITH RELAYING

A log of relay operations on the Duquesne ring and general operating experiences with relays on this system formed material for a paper by H. P. Sleeper, Duquesne Light Company, Pittsburgh. The total faults on the ring were forty-three in number, and thirty-six of these gave 100 per cent relay operation. Incorrect or unnecessary relay operation resulted in six cases, and other incorrect operations were eleven in number, while only one fault was involved in a relay failure. The over-all operating efficiency of the relays was 97.7 per cent, and changes have been made which greatly increase this figure.

As a result of the experiences to date with this relay system, certain conclusions have been reached as follows:

1. It must be possible to operate the ring with one or more single-line sections in circuit, without danger of dropping these sections when faults occur on other sections.

2. Some system of interlocking must be used which will be capable of more accurate time settings than the present, and especially one whose failure to function properly cannot leave any lines without protection.

3. Every system of primary relaying must be provided with a system of back-up protection which will act if the first system fails, a "second line of defence," as it were. These features are now being applied to the ring.

4. Means must be provided to give protection for faults occurring inside the tanks of circuit breakers.

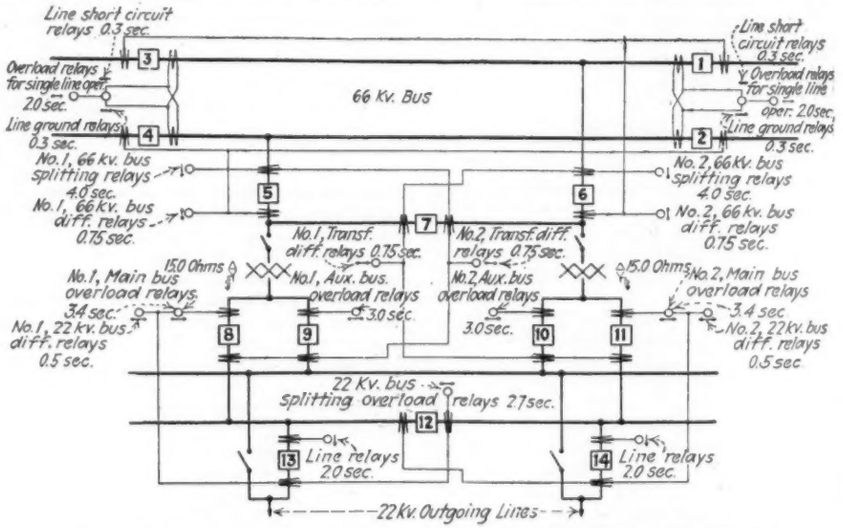
5. It must be possible automatically to remove any single unit from service at a station without killing this station.

The accompanying illustrations show how the relaying has been modified to meet these conclusions as to protection.

All these modifications have been made successfully and as a result of the past eleven months' experience many valuable lessons have been learned. These have been carefully weighed and acted upon. Systems of this kind, with this type of protection, are still young and present many problems which are novel and interesting. It is, nevertheless, confidently believed, Mr. Sleeper said, that the performance so far will compare extremely favorably with that of any equivalent system during the same time. It is further believed that with the additional safety features added, as described in this paper, the coming year will considerably better the record.

### DISCUSSION ON ARRESTERS

In the discussion of the papers on arresters E. E. F. Creighton, General Electric Company, asserted that on 220-kv. systems arresters are not used because of higher insulation values and other elements, but that as the voltage decreased the value of arresters became greater. Caution must be maintained in using field-test results on arresters, because it is extremely difficult to obtain accurate and reliable measurements, particularly on discharge rates. Mr. Creighton said that several years'


Line short circuit relays 0.3 sec.
Overload relays for single line oper. 2.0 sec.
Line ground relays 0.3 sec.
No.1, 66 kv. bus splitting relays 4.0 sec.
No.1, 66 kv. bus diff. relays 0.75 sec.
66 Kv. Bus
No.1, Transf. diff. relays 0.75 sec.
No.2, Transf. diff. relays 0.75 sec.
150 Ohms
No.1, Main bus overload relays 3.4 sec.
No.1, Aux. bus. overload relays 3.0 sec.
No.2, Aux. bus overload relays 3.0 sec.
No.1, 22 kv. bus diff. relays 0.5 sec.
22 Kv. bus splitting overload relays 2.7 sec.
Line relays 2.0 sec.
22 Kv. Outgoing Lines
No.2, 66 kv. bus splitting relays 4.0 sec.
No.2, 66 kv. bus diff. relays 0.75 sec.
No.2, Main bus overload relays 3.4 sec.
No.2, 22 kv. bus diff. relays 0.5 sec.

RELAY PROTECTION FOR RING SUBSTATION WITH 66-KV. AND 22-KV. BUSES

To secure a second line of defense to two different systems of relaying—the line relays and the station protection—the system shown above is used. It consists of reverse-power relays on each 66-kv. transformer breaker set to trip for power flowing from the ring to the station bus. The trip circuits of these two sets of relays are crossed—that is, the relays on No. 5 transformer breaker trip transformer breaker No. 6 and vice versa—thus securing back-up protection for the line breakers. For example, assume that a fault has developed on the line coming in to No. 1 breaker. The breaker at the other end has opened correctly, but breaker No. 1 at this station has for some reason failed to open automatically, thus placing a balanced fault on the ring which cannot be detected by any of the remaining balanced types of protection. This would shut down the system unless special means were provided to relieve it. This is accomplished by the No. 1 66-kv. bus-splitting reverse-power relays, which respond to the power passing through the bus tie feeding into the fault. These relays will trip breaker No. 6, which leaves all the station load on the good line and by splitting the bus has taken the balance off the lines. This passes the trouble back to the next adjacent station, where the line relays will operate to clear the fault.

Faults inside breaker tanks are remedied by overlapping the protection round each circuit breaker. On a line breaker the relays are connected to the current transformers on the bus side of the breaker and the bus differential relays are connected to the current transformers on the line side of the breaker. Consequently, a ground circuit inside a tank will operate both the line and bus relays, cutting off all feed to the fault.

The arrangement shown also prevents a 22-kw. bus short circuit from killing the station. It consists of a bus-tie breaker in the main 22-kv. bus and the protection of each section of this bus by bus-differential relays. An additional set of overload relays is inserted between these buses to act as bus-splitting protection. This scheme completes a second line of defense for 22-kv. outgoing line breakers. Thus, if line breaker No. 14 fails to open for a fault on its line, this will put the trouble on No. 2 section of the 22-kv. bus, which will then be cleared by the bus-splitting overload relays opening bus-tie breaker No. 12 and No. 2 main-bus overload relays opening breaker No. 11. This will clear the fault and leave the station hot on the No. 1 section of the low-tension bus. If the fault had been on the bus itself—caused, for instance, by the failure of line No. 14—this would have operated the No. 2 22-kv. bus differential relays and opened breakers Nos. 11, 12 and 14 and the breaker of any other outgoing lines from this section of the bus.

ARCING GROUND ON 22-KV. LINE OF DUQUESNE LIGHT COMPANY

This shows a 50,000-kva. arc forming in the still air and clearing itself before the circuit breakers operated. This was taken as part of the tests to determine the relay performance on the system. With a 15-ohm ground resistor the arc rose 8 ft. into the air before breaking.

research on the electrolyte-tube type of arrester had convinced him that it could not be relied upon to relieve a line from lightning disturbances for two reasons—first, it has too small a maximum discharge rate and, second, the dynamic current pushes the water column down the tube and makes steam, leaving a definite time period where the arrester would not be in service operation during a lightning storm.

K. B. McEachron, General Electric Company, thought that the use of two gaps in Mr. Young's tests introduced an error as the charge on the condenser was determined by the relative capacity of the two gaps and consequently the voltages tabulated might be seriously wrong. He also maintained that oscillograms would have added greatly to the value of the tests.

G. H. Middlemiss, Alabama Power Company, said that arresters were used on the Alabama Power Company's 44-kv. system to protect transformers only and not for line protection. He stated, referring to failures of 44-kv. transformers, that in 1921 60 per cent of coil breakdowns occurred during lightning storms; in 1922, 30 per cent, and in 1923, 45 per cent. These failures did not include flashovers or bushing troubles, and it was difficult to determine whether coil failures were all due to lightning. He declared that it was difficult to draw conclusions as to the value of arresters since transformers had failed when completely equipped with arresters. Considering the relative number of transformers involved, there had been no more failures on the 110-kv. system (with no arresters) than on the 44-kv. system (with arresters).

J. S. Jenks, West Penn Power Company, said that experience had shown that company that the connection of an arrester was as important as its selection as to type. He asserted that a dip in the line to the arrester greatly aided operations.

A. L. Atherton thought that the value of arresters must be considered on the basis of a grand average. He said that the study of D. W. Roper years ago showed conclusively the economic worth of arresters on low-voltage installations and that a similar grand average was needed for high-voltage conditions. Spotty or local conditions could not be held indicative of best practice generally.

H. M. Towne said that the electrolyte-tube type of arrester changed in conductivity with frequency and salt content and would offer to a disturbance with a frequency of a million cycles a path having a resistance equivalent to that of a copper wire a quarter of a mil in diameter.

C. E. Bennett said that the water column in the electrolyte tube arrester was pushed down a maximum of 10 in. and that the dynamic current was interrupted in a half cycle. He added that only small amounts of energy are handled by arresters usually and that the early-starting, slow-discharge rate prevented excessive short circuits on steep-wave-front impulses. He thought the arresters should be used as multiple leakage points to relieve the system from impulse surges.

## Southern Power Development and Other Topics

AN ADDRESS by Thomas W. Martin, president Alabama Power Company, on Southern power developments was a feature of the Tuesday afternoon session. In this address Mr. Martin showed how electrical power had made possible the great industrial progress of the past few years. He also presented an analysis of the Muscle Shoals situation and discussed the various offers now before Congress. In discussing power conditions in the South Mr. Martin stated that in 1923 the output of the power companies in the interconnected group was more than three billion kilowatt-hours, an increase of 20 per cent over 1922. The maximum demand on the systems is 750,000 kw. and the connected load more than 2,000,000 hp. By 1924 there will be an installed capacity on the systems of 1,781,155 kva. with an estimated output of more than five billion kilowatt-hours. The value of interconnection was indicated by the fact that 87,000,000 kw.-hr. was interchanged in 1921 and 236,000,000 kw.-hr. in 1923. Mr. Martin said that interconnection was the logical working out of economic laws and that the utilities concerned had vision sufficient to grasp the possibilities of interconnection.

Mr. Martin also presented for the benefit of those attending the convention an analysis of the Muscle Shoals situation. He showed how the development was on property formerly owned by the Alabama Power Company and donated to the government to meet a wartime emergency and how, the war over, the Alabama Power Company was the first to make an offer to the government to purchase the property and develop it. Mr. Martin then outlined and compared the offers of Ford and of the power companies.

Following this address H. M. Addinsell of Harris, Forbes & Company, New York, discussed the financial aspects of utility development. He stated that the utilities were doing a great work in cultivating the habit of individual thrift through customer-ownership campaigns and that this habit of thrift benefits individuals and the nation, for it stabilizes national conditions and makes for the prosperity of all. He stated that a quarter of a billion dollars of new capital per year must be raised by utilities through the sale of junior securities and that the adoption of the customer-ownership plan had both raised the money and brought about a real and valuable public ownership of utilities; but he issued a word of warning to the effect that the utilities must protect these small investors and must safeguard the movement from ill-advised or speculative exploitations by irresponsible persons.

### HIGH-TENSION NETWORKS

An able paper by Percy H. Thomas, consulting engineer, New York, was presented describing a new type of interconnected high-tension network. The salient features of the principle were illustrated by application to the present and predicted power systems in the Southeast. A network of single-circuit lines was proposed with two-point feeding to all load centers. The power spreads on the network as the distance from generating sources increases, and power may be tapped from the system at any point. The system involves fixed voltages at multiple points independently of load, although the voltage values at the several points are not the same but range from 180,000 to 203,000. No synchronous condensers are used, and the usual heavy charging currents are counteracted by the lagging loads. Mr. Thomas proposed to use a divided conductor giving a reduction of inductance, an increase in capacity and an increase in the critical corona voltage. The line loss was estimated to be less than 12 per cent, and from 100,000 kw. to 200,000 kw. could be taken at any point without difficulty.

Another paper of interest, by N. H. Slaughter and W. V. Wolfe, both of the Western Electric Company, discussed carrier current for communication on power systems. The system described employed a metallic circuit and only 1 watt of energy was used. Condenser couplings to the line wires were used instead of the inductively coupled antennas. The losses in carrier systems are those occurring in the line, in the connected power equipment and in the equipment of the carrier installation, and of these the line loss is small, that of connected equipment is a function of the carrier frequency, and the most serious is that associated with coupling the carrier equipment to the power line. The condenser coupling was held to be more efficient and less hazardous.

In the discussion of the papers Robert Treat, General Electric Company, observed that engineers must consider the future when laying out lines and stations and that a unified program would be advisable where several companies were interconnected. He also brought out the fact that the use of high-tension and low-tension interconnections called for rather compli-

cated mathematical solutions to determine electrical quantities at any point on the system under assumed conditions of design. It was also often necessary to control independently both voltage magnitudes and phase conditions at one or more points, and apparatus for doing this was not yet satisfactory for all conditions if watt and wattless components were to be controlled.

W. S. Lee, Southern Power Company, held that it is impossible to lay out a transmission system that will satisfy all present and future conditions, but the principles and methods suggested by Mr. Thomas would be welcomed by many engineers. W. E. Mitchell said it was not an easy operation to get power interchanges on interconnected systems and that directional control of power required careful governing and regulation. The governing problem is solved quite readily by adjustments to suit the interconnected conditions, but regulation was more difficult, since the wattless components might be given to the system trying to supply the actual power. This condition is a question of voltage control, which must be made at the generating stations. H. S. Fitch, West Penn Power Company, said that the West Penn system placed synchronous condensers at the weak voltage points on the system and used idle generators to control regulation. He also thought relays to be of fundamental importance when interconnecting systems.

In discussing carrier currents L. F. Fuller, San Francisco, said that while the efficiency of transmission was greater with the full metallic circuit than with the ground-return circuit, there were other factors to be considered. Whether 1 watt or 100 watts were used by the carrier seemed of little importance in comparison with other features. For example, the full metallic circuit was often totally inoperative if one of the two power wires failed, while all but one on the ground-return system might fail without interrupting communication. He questioned the cost and safety values of the metallic system with condenser connection to the power wires.

L. P. Ferris, American Telephone & Telegraph Company, showed slides giving quantitative values of losses on carrier systems, and G. Y. Allen, Westinghouse company, asserted that the cost of condensers in the system proposed might equal the cost of the carrier equipment. E. B. Craft, Western Electric Company, said that a fundamental basis of attack on carrier systems was to get the most efficient system as a starter and that carrier systems must be developed to satisfy conditions in a whole superpower district.

W. V. Wolfe said a telephone system must be duplex to be satisfactory, and that it was advisable to use a minimum amount of energy to operate communication equipment. He also observed that radiation and interference on ground-carrier systems might develop so as to conflict with radio broadcasting requirements. In his opinion, costs of communication equipment were small as compared with the value of uninterrupted communication under all service conditions.

## National Aspect of Water-Power Development

ON TUESDAY night O. C. Merrill, executive secretary Federal Power Commission, gave an address on national water-power development. After pointing to the great hydro-electric development of the Western coast, Mr. Merrill discussed the superpower systems which the government hopes to see interconnected in a nation-wide web of transmission lines. This development is economic and expedient, he said, for the reason that electric power cannot be stored, and interconnection with other lines transmitting power to a distance will make it possible for each system in the general plan to dispose of energy not needed locally except at the "peak" hours. Superpower distribution, he said, will provide improved electrical service, will make practicable a much greater use of the nation's water powers with a consequent saving of fuel and reduction of rates, and, finally, will bring about the decentralization of industry.

The federal government today is exercising control over about 85 per cent of all the water-power resources of the country, he said—a step in conservation that was taken in time, unlike the history of the exploitation of other public resources. "This control is being exercised for two primary purposes," Mr. Merrill declared, "to guard against improvident use of a public resource and to retain these resources in public ownership that they may not be capitalized for purposes of rate making or of sale."

P. M. Downing, vice-president Pacific Gas & Electric Company, talked on the best ways of using water power for the benefit of the public and cited conditions in California as indicative of what has been done through the initiative and foresight of utilities. After telling of various attempts made in California to put all such utilities under state ownership, the last one having been defeated by a majority vote of three to one, Mr. Downing declared that another "political epidemic" was raging and that the same proposal would undoubtedly come up again at the election in November.

Preston S. Arkwright, president Georgia Railway & Power Company, talked on the value of public relations in water-power development, asserting that without public sentiment nothing can succeed and with it nothing can fail. He pointed out the difficulties which have had to be met by public utilities in overcoming hostile public sentiment and politicians and sounded a warning against getting the water-power companies in the position that has been occupied by the steam railroads and street-car companies.

Heavily scoring the policy of conserving by not using when a tremendous benefit could be brought about by use, Mr. Arkwright showed how users of water power are not affected by strikes, inadequate railroad facilities and other adverse conditions, while the rates are largely uniform. He also pointed out that in developing water power nothing is destroyed, nothing used up and no property rights invaded, but, on the other hand, the rates are fixed by law, capitalization and service are supervised and the companies are required to serve everybody without discrimination. Declaring that many wrong impressions prevail in the public mind, Mr. Arkwright urged electrical engineers to inform the public of the real meaning of this development. He also warned against the attempting "socializing" of the industry and making it a "political operation."

## Lively Session on Oil Circuit Breakers

OIL BREAKERS received attention in a series of five papers on Wednesday morning. Three of the papers gave data and conclusions based on breaker tests at 44 kv. and 110 kv. on the system of the Alabama Power Company. H. J. Scholz of that company described the test methods and the system used, R. W. McNeill discussed the tests made on breakers manufactured by the Westinghouse company and A. J. D. Hilliard those made by the General Electric Company.

Conclusions as a result of the tests made by Mr. Scholz were that breaker tests could be made on an interconnected system without serious operating inconvenience and that breakers should be rated on three-phase short-circuit values. Specific conclusions were that breaker tanks should be round, made of boilerplate and strong enough to withstand maximum pressure due to explosions inside. Breakers should also be completely sealed and baffled to prevent oil throwing, and all installation parts above the oil level should be grounded to prevent the accumulation of static.

As much as 250,000 arc kva. was obtained on the 44-kv. tests on Westinghouse breakers and 650,000 arc kva. on 110-kv. tests. On the 44-kv. tests the surge recovery voltage was at times 60 per cent greater than the initial, but this phenomenon did not occur on the 110-kv. tests. On the tests made on the 110-kv. breakers made by the General Electric Company Mr. Hilliard said that rupturing capacity was increased by putting explosion chambers on the rebuilt breakers. He held that breakers should be designed to operate under the worst possible conditions.

A paper on oil breakers from the operator's point of view was presented by J. S. Jenks, vice-president West Penn Power Company. He described his experiences with breakers on the West Penn lines and maintained that the operator has not determined his breaker needs, that the manufacturer has not fitted himself by research work to meet the operator's needs, and that the operator and manufacturer have not co-operated to develop, operate and maintain breakers as they should. He advocated a greater application of the multiple-break principle in breakers.

A paper by A. J. D. Hilliard was presented describing investigations made recently by the factory-testing equipment of the General Electric Company and giving the results so far

obtained. He concluded that break distances should be based on the worst possible conditions such as a dead short on generator terminals on an ungrounded system. The interrupting capacity of a breaker, he said, depends on the speed of break and depends on the quantity of gas generated and the speed of gas generation. It does not follow necessarily that the greater the speed of break the greater the interrupting capacity. The head of oil in a breaker was found to affect its performance appreciably, and venting is a very important consideration. Linings have been found necessary as a result of the tests. Contacts must be designed properly to prevent burning and secure heat dissipation. The quality of oil has been found very influential, and breaker duty is increased when low power factors are encountered. Many elements have been found to be variable and influential, and only tests made under worst possible conditions should be used to determine ratings.

In the discussion J. B. McNeill said that secondary explosions could be caused by either static sparks or hot gases and that recent researches have made possible the use of the same oil for both breakers and transformers. He held that the effect of the flash point has been exaggerated. High recovery voltages on the 44 kv. tests were explained on the basis of an inadequate ground. W. E. Mitchell, Alabama Power Company, said that oil breakers must be developed on the basis of views of both operators and manufacturers. The design function is the manufacturer's, but the operators should furnish the facts of service requirements. Breakers must open fault circuits on systems and conform to service requirements. Further developments are necessary before they are satisfactory from this standpoint. They are not sufficiently rugged or simple for service requirements.

J. M. Oliver said secondary explosions have given most trouble in breakers on the Alabama Power Company system. Circuits may have been opened a minute when a secondary explosion has occurred and wrecked the top of the breakers. As the system will soon have a possible fault kva. of over a million and a half, it is desirable to know whether breakers can be counted upon to handle this or if the system must be baffled, so to speak, to limit fault kva.

P. M. Downing said the function of operating companies is to give service and the manufacturers should furnish the necessary equipment. Services are becoming increasingly severe and breakers must meet these conditions at a reasonable cost. The present cost of high-tension breakers is very large, and in addition systems cannot be built around breakers or service curtailed because of limitations of breakers. Better breakers are needed and the two-minute duty cycle is too long. G. E. George stated that service must be restored promptly and that breakers should not have a time element in their rating in excess of 20 or 30 cycles.

A. J. D. Hilliard said that the arc in a breaker is interrupted by the dielectric gas stream and that this is a function of the temperature and the pressure. Both the amount of gas and its rate of formation affect interruption capacity, and if the breaker distance is not sufficient to break the arc, the continued formation of gas would result in an explosion. The gas forms very rapidly, 125 gal. having been developed in one-tenth second at times. Mr. Hilliard asserted that the explosion chamber increased the pressure and also directed the ionized gas stream toward the oil for cooling.

G. H. Middlemiss said it would be very difficult to secure a breaker duty cycle that would be acceptable for all operating conditions. He asked what multiplier should be employed if breakers are used on other than standard-duty cycles to obtain their rating. It would be desirable also, he said, to determine how many standard-duty cycles a breaker would stand before it became necessary to take the tank down for contact inspection and possible repair. J. B. McNeill said that recent investigations had shown that the effect of pressure is to increase the gas emission when circuits are interrupted. The pressure had an advantage, however, in giving a breaker force to prevent ignition. A. J. D. Hilliard said that it was important that breaker users use oil specified by the manufacturer as the gas evolved varied widely with different oils and may range from eight units to eighty units.

J. S. Jenks said that service requirements were becoming increasingly severe and that system capacities were growing very rapidly, and yet it was necessary to look ten years ahead when using breakers. He declared that no time element could be permitted in a breaker rating if service conditions were to be met and presented a set of breaker specifications for consideration. He stated that operators do not know their breaker requirements, are not equipped to make the necessary tests and should not be called upon to do so. In his opinion the following features characterize an adequate breaker:

(a) The operating device should be small and motor-operated from a battery.

(b) The operating mechanism and all operating units should be rigidly tied together by a steel structure so that alignment and levels will be maintained.

(c) All multiplying attachments should be removed from the breaker proper and put into an open and readily accessible housing sufficiently large to hold necessary relays and permit of easy repairs.

(d) The operating mechanism should trip free, leaving a minimum mass to be moved, and there should be available hand-closing attachments. The trip should be positive, be in position when the breaker is closed and should reset itself.

(e) The tripping device should be connected to the operating mechanism so that the breaker would be instantly reclosing at least so far as the breaker mechanism is concerned. This is necessary if a breaker is used to operate quickly when it is desired to cut out trouble feeding a tap through an air-break switch.

(f) The mechanism should be a torsion shaft to secure close fitting, to hold gas and moisture out.

(g) The series transformer should have variable taps, confined in the bushing support casting and sealed from gas and arc chambers, be removable with the bushing and connected through leads in conduit entirely outside the breaker.

(h) The bushings should be rigid and liberally designed to withstand the maximum stresses, and the tank should be top-attached and sealed by a gasket that closes tighter with increasing pressures. The tanks should drain at the lowest possible level and should be equipped with permanent lifting facilities. All openings should be impervious to capillary attraction and moisture.

(i) The lining should be fire-resisting and so supported as not to absorb moisture from the bottom of the tank.

(j) At least six magnetically directed barrier contacts should be provided and arranged to segregate the gas volumes.

(k) The top of the breaker should have a baffle to prevent oil throwing, and the breaker should be hermetically sealed and provided with a breather.

(l) Without oil throwing the breaker must operate five times consecutively and be fit for service independently of system conditions.

## Developments in Electric Machines

AN INTERESTING paper was presented by Val A. Fynn, consulting engineer, St. Louis, on Wednesday afternoon describing a new type of commutator motor which possesses slip-ring induction-motor torque characteristics and operates at high power factor by using a commutator winding excited by current supplied at slip frequency. W. J. Foster and A. E. Glass, both of the General Electric Company, described the 65,000-kva. generator installed at Niagara Falls, which is chiefly notable for its size, its design details and the unusual ventilating arrangements. C. A. M. Weber, Westinghouse company, indicated a method for determining the effect of space harmonics due to slots in small motors and showed how low pull-up torques were the result of these harmonics. The last paper, by F. F. Brand, General Electric Company, described the design details of the 22,000-kva. transformers recently installed at Niagara Falls.

In the discussion that followed S. R. Bergman, General Electric Company, stated that the motor that gave a minimum yearly operating cost was best and that as regards first cost, maintenance cost and costs due to operating delays the motor described by Mr. Fynn was inferior to the induction motor. F. J. Rudd, General Electric Company, thought that it would be difficult mechanically to fit the proposed motor in small sizes to special applications and that insulators would be difficult on larger and higher-voltage units. Val A. Fynn said that power factor was important and that as compared to static condensers in conjunction with induction motors the motor proposed was better on a cost

and operating basis. It was not proposed as a universal motor but was a development for securing power-factor correction in motor installations.

L. P. Ferris, American Telephone & Telegraph Company, said the study of harmonics in machines was encouraging to the engineers interested in inductive co-ordination, and F. S. Dellenbaugh, Jr., consulting engineer, Cambridge, Mass., said that the methods devised were readily applicable to generators. He also said that machines designed to have low harmonics have low reluctance to harmonics in parallel machines having harmonics, and that sometimes this would give rise to appreciable circulating currents.

## Substations and Hoists in Mines and Steel Mills

THURSDAY was spent on an inspection trip to the Lock 12 power house and Mitchell Dam power house. In the evening a technical session was held at which several papers were presented dealing with subjects connected with mines and steel mills. Safety in coal mines was the subject of a paper by L. C. Ilsley, United States Bureau of Mines, in which he outlined the responsibilities resting upon electrical engineers to reduce safety hazards to a minimum. In 1919 there were 42,230 motors in mine service with a total horsepower rating of 1,578,474, Mr. Ilsley said, and in many other ways electricity has had a very large application. Precautions must be taken to guard circuits so that shocks may not occur even with voltages as low as 110. Another hazard is the use of explosives around electricity and all powder cans or boxes must be handled so that electricity from the trolley or rails cannot pass through them. Moreover, electric wires should not be used near detonators or detonator leads. Flashes may cause explosion of mine gas, and overheated wires are dangerous as they may ignite gases or dust. Another hazard is from fires from faulty circuits, and circuit installations in mines should be made very safe and thorough. The operators, the engineers and others are helping to produce better results, and there is opportunity for great improvements in both installation and operation.

Automatic substations for mines were treated in a paper by C. E. Von Sothen. Mining loads are similar to railway loads in many ways, he said, but fluctuate more rapidly, and frequent short circuits are apt to occur. This makes it difficult to provide continuous service, yet production and safety requirements require high-quality service under all conditions. At present three methods are used to meet mine substation needs —(1) single-unit manually operated converter units at each important load with an attendant at each station; (2) single-unit manual stations near locations where workmen may give casual attention to them, and (3) where large power concentrations are advisable two or more manual units are installed together and an attendant is provided. Of recent origin are developments of semi-automatic and fully automatic mine substations which have proved practicable and useful for many mine installations. The degree of automatic control depends on service requirements, but experience has indicated that automatic stations have great advantages as they may be installed where desired and operate more reliably than manual stations. In the final analysis an economic condition is found to govern their use, and studies show great opportunities for use in mine service.

Some general notes on mine-hoist control were presented by F. L. Stone and F. R. Grant, General Electric Company, of which the outstanding feature was the report that designs have reached such a rational basis that predicted results and test results on hoist-duty cycles check very closely. Through careful design, moreover, the hoist equipment has been improved to wipe out peaks and heavy overloads and to insure smooth and desirable speed characteristics for each part of the duty cycle. A specific test with oscillographic records was made on a large mine installation using Ward Leonard control system to determine actual data, and the results closely checked design predictions. The hoist used 2.25 kw.-hr. per total trip, or 1.41 kw-hr. per 1,000 ton-ft.

The general subject of automatic substations was treated in a paper by Chester Lichtenberg, General Electric Company. He discussed the development of the automatic principle and its application to all types of units, such as generators, motors, synchronous motors, motor-generators and synchronous condensers, on an application basis, and showed a film to support the statement that the very difficult problem of railway automatic substations had been solved successfully, and that therefore little difficulty need be expected in applying the automatic principle to other less difficult applications. He described the fundamental automatic-control principles now used for each type of application, discussing briefly the subject of reclosing breakers with automatic trip.

In the discussion C. A. Butcher, Westinghouse Electric & Manufacturing Company, said that automatic generating stations up to 8,000 kw. were feasible and practicable and that automatic installations had proved more reliable than manual ones. He thought that the periodic reclosing principle for breakers had worked out very successfully, and he outlined many governing principles in the use of automatic control for industrial purposes.

Carl Lee, Peabody Coal Company, Chicago, said that his experience with electric and steam hoists showed that a great advantage of the electric hoist was the fact that its efficiency remained constant over a period of years, while that of the steam installation decreased. He gave a nine-year average mine record of 0.63 kw.-hr. per ton of material moved by an electric hoist as evidence of the efficiency of electric hoists.

G. H. Finks, Alabama Power Company, stated that only slope hoists were used in Alabama, but that with this type of hoist his experience showed that accurate calculated values checked test results. With the slope hoist loads and grades vary, and he suggested that regeneration might be used to eliminate some difficulties of unbalance. He asserted that momentary peaks made little difference in cost with energy purchased on a fifteen-minute demand basis.

F. L. Stone, General Electric Company, said regeneration in hoisting was used, but that the power companies often put a ratchet on the meter to prevent the hoist user from reaping its financial benefits. Prof. W. I. Slichter, Columbia University, New York, indicated the progress made in eliminating labor and capital in hoist applications.

## Consideration of Industrial Problems

A 20-16-IN. hot-strip mill recently installed in the plant of the West Leechburg (Pa.) Steel Company was described in a paper by Noble Jones of that company and G. P. Wilson, Westinghouse company, at the Friday morning session. The distinctive feature of the mill is the tandem arrangement of the finishing stands, which takes the metal before it is reduced to a thin section and finishes it before it has an opportunity to lose its heat. Each stand is driven by an adjustable-speed direct-current motor, making it possible to draft the steel as desired, since there is no mechanical connection between the individual stands.

E. T. Moore, Halcombe Steel Company, in discussing maximum-demand regulators for electric furnaces described an attachment for a wattmeter to limit the load in furnaces or mills. This attachment actuates a lever which is connected to a second lever (actuated by a clock) in such a way that for predetermined conditions the two levers make contact jointly to cause a secondary control system to limit the energy supplied.

In a paper on "Manufacture of Phosphoric Acid in Electric Furnaces," by Theodore Swann and F. V. Andrea, both of the Federal Phosphorus Company, the authors showed that this method of making acid offers a great opportunity for use of secondary power. They expressed the belief that electric furnaces can ultimately be used to produce enough ammonia to compete with the natural saltpeter process.

G. W. Vinal and F. W. Altrup, United States Bureau of Standards, gave a paper on storage-battery electrolytes and showed the effect of detrimental impurities in them, which consisted of platinum, copper, iron and manganese.

In the discussion following G. E. Stoltz, Westinghouse company, discussing Mr. Moore's paper, said that the maximum-demand regulator principle would be welcomed by both the user and the producer of electric furnaces and mills and outlined his reasons. L. M. Nash also thought that power companies would welcome demand-limiting devices. In closing the discussion on this paper Mr. Moore said that the human element must be eliminated entirely if satisfactory peak limitations are to be obtained.

The paper by Messrs. Swann and Andrea provoked a long discussion, and the fact was accented that fertilizer needs ammonia, potash and sulphur and that nitrogen in itself is not a complete plant food.

# The Klydonograph*

## An Instrument for Accurately Measuring and Recording Voltage Surges—Discussion of Tests on Which Calibration Is Based—Photographic Plate Figures Give Detailed Information of Surge Characteristics

By J. F. PETERS

*Transformer Engineering Department, Westinghouse Electric & Manufacturing Company*

THERE is plenty of evidence that surges of considerable magnitude appear on extensive transmission systems, and it is undoubtedly desirable that detailed information concerning them be obtained. From what data are available it is rather evident that many surges of very high value exist which have an extremely short duration. Practically all data concerning these surges have been obtained by the use of spark gaps in some form or other. It has been assumed that a sphere spark gap can be made to have practically zero time lag of breakdown, and it has been used as a standard in determining the duration of these surges. But a sphere spark gap has a considerable time lag where the voltage in excess of its flashover value is comparatively small.

The object in the development of the instrument to be described in this paper is to provide some means that will record voltages, whether of extremely short duration or not, and to produce a graphic record of detailed information concerning the surges, such as polarity, magnitude, steepness of application, etc.

This instrument is based on an old principle that was first observed in 1777 by Dr. Lichtenburg and makes use of figures known as Lichtenburg figures. Dr. Lichtenburg found that on discharging a condenser such as a Leyden jar across a spark gap onto a terminal in contact with an insulating plate placed between this terminal and a ground plate, and then sprinkling powder on the plate, the powder would arrange itself in the form of a figure that had certain very peculiar appearances. By using powders of different colors beautiful figures could be produced, the figure produced by a positive charge being entirely different from that produced by a negative charge. In 1888 J. Brown and E. Trowvelot found that on replacing the insulating plate with a sensitized photographic plate, the emulsion being in contact with the terminal, and developing the plate, figures very similar to those produced by Lichtenburg were found. Since Dr. Lichtenburg's time the Lichtenburg figures have been studied by many investigators. The most recent study was a very complete exposition of these figures given by P. O. Pederson.† Apparently very little is known about the actual cause of the Lichtenburg figure on photographic plates, although many investigators have attempted an explanation of this phenomenon. No attempt will be made in this paper to explain the action taking place in the emulsion of the photographic plate, but it will be con-

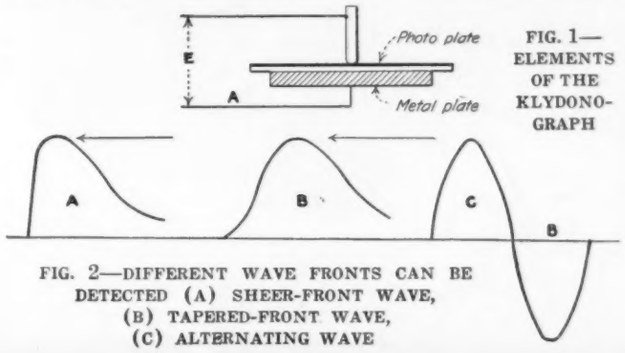
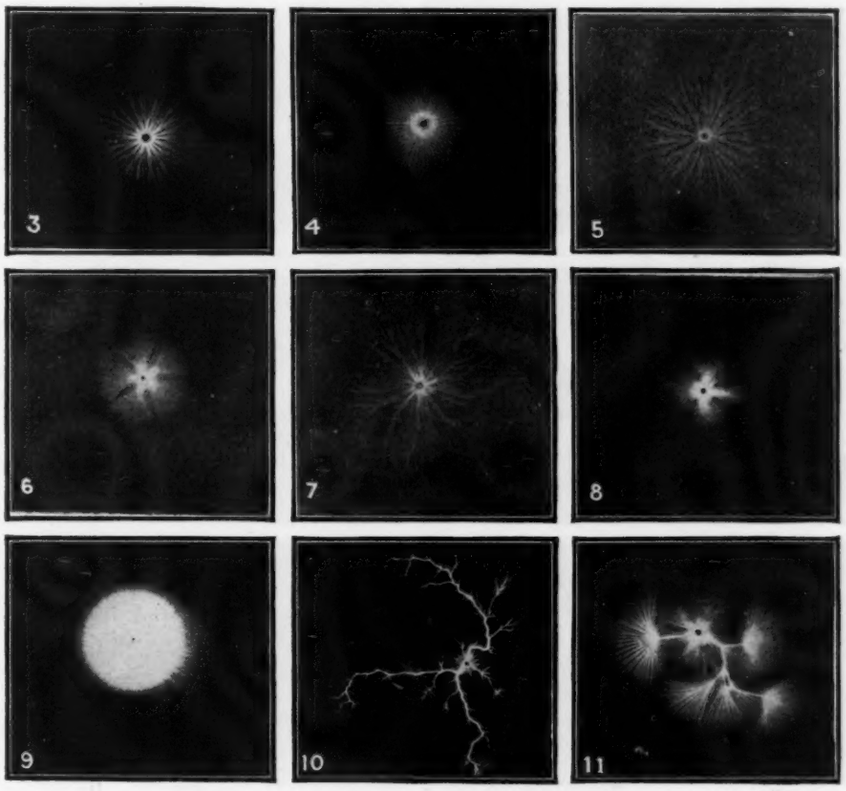



FIG. 1—ELEMENTS OF THE KLYDONOGRAPH

FIG. 2—DIFFERENT WAVE FRONTS CAN BE DETECTED (A) SHEER-FRONT WAVE, (B) TAPERED-FRONT WAVE, (C) ALTERNATING WAVE




THE KLYDONOGRAPH'S RECORDS OF VARIOUS SURGES

Fig. 3—A positive surge with an abrupt front. Fig. 4—A negative surge with a steep front. Fig. 5—A surge of a wave similar to Fig. 2(b) with a 5-microsecond front. Fig. 6—A negative surge with a 5-microsecond front. Fig. 7—A positive surge with a 200-microsecond front. Fig. 8—A negative surge with a 200-microsecond front. Fig. 9—A 60-cycle alternating voltage. Fig. 10—A positive surge above the working range of the instrument. Fig. 11—A negative surge occurring above the working range of the instrument.

*The word "klydonograph" was coined by Dr. Roscoe M. Ihrig of the Carnegie Institute of Technology. It is derived from the Greek words "kludon" and "graphos." "Kludon" means "billow" or "wave" and has a related adjective "kludios," which means "surging," "dashing." "Graphos" means "a writing" and from it, of course, many scientific terms are in part derived, as, for instance, "telegraph" and "oscillograph."

†*Det Kal. Danske Videnskabernes Selskab*, 1919.

fined to the use of the figures as a means of obtaining detailed information concerning surges.

The klydonograph in its simplest form is represented in Fig. 1. The photographic plate, of course, must be placed in a dark box. If a voltage is impressed between the terminal and ground plate, as at *E*, on developing the photographic plate figures will appear that will give pertinent information concerning the nature of the

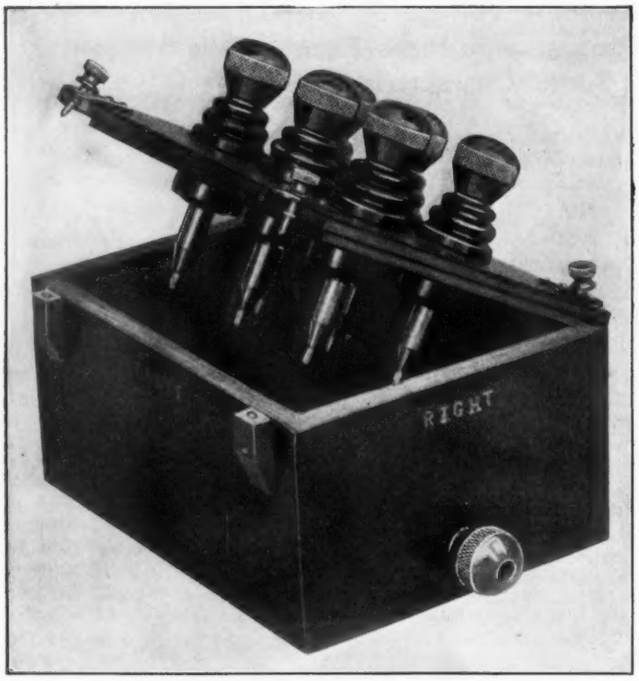



FIG. 12—THE KLYDONOGRAPH USED TO RECORD THE SURGES ILLUSTRATED

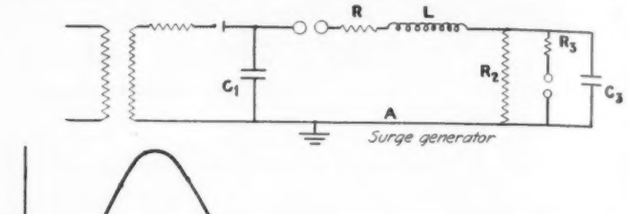
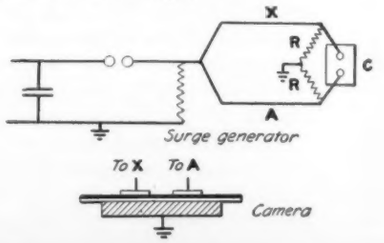
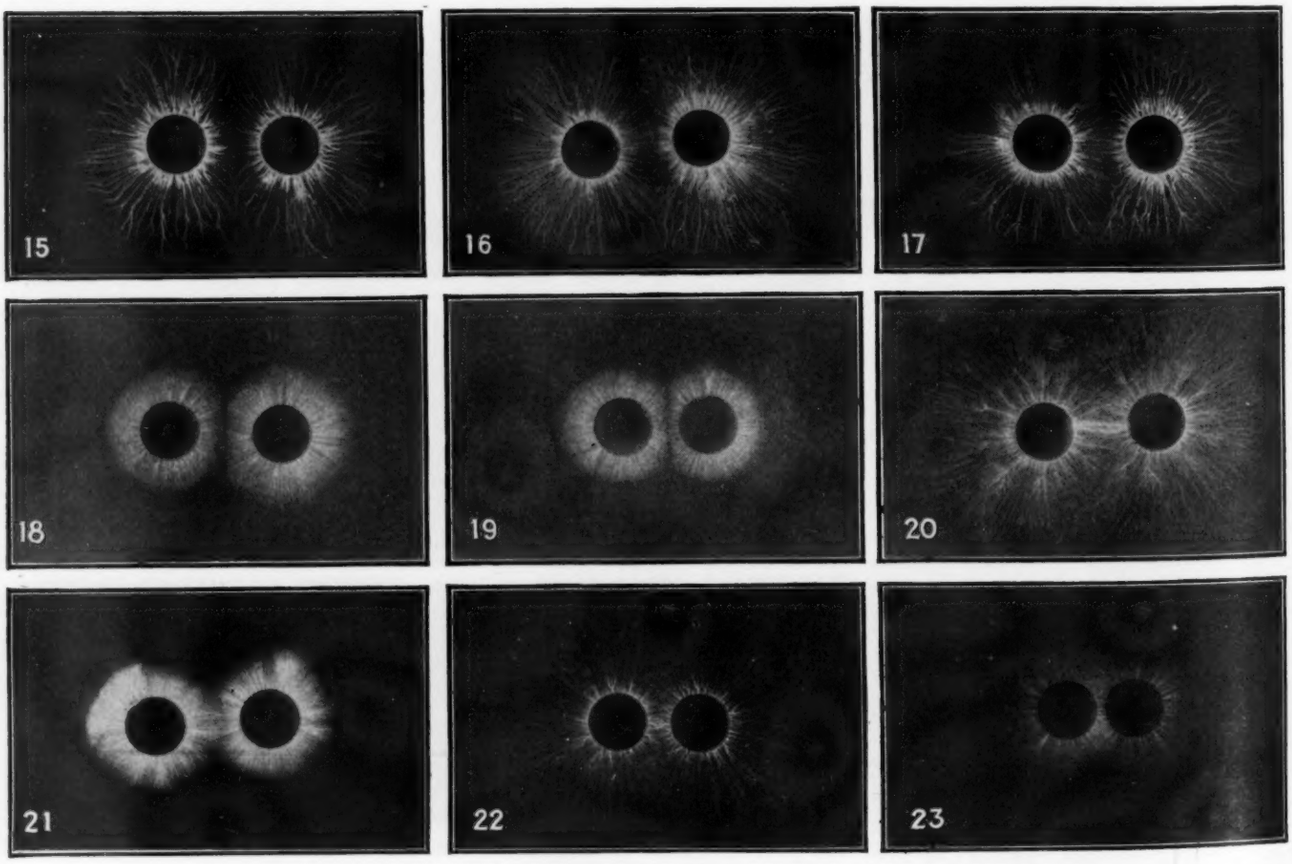


FIG. 13 (A)—NETWORK USED TO PRODUCE SURGES IN THE LABORATORY

FIG. 13 (B)—GRAPH OF A TYPICAL SURGE PRODUCED BY THE NETWORK OF FIG. 13 (A)

FIG. 14—NETWORK USED TO GET SHORT TIME SURGES




THE KLYDONOGRAPH MAKES RECORDS OF SURGES ON TWO LINES AS WELL AS ONE

Fig. 15—A positive surge on two lines 95 ft. long.

Fig. 16—A positive surge on two lines of unequal length, $A = 30$ ft., $X = 50$ ft.

Fig. 17—A positive surge with $A = 50$ ft., $X = 140$ ft.

Fig. 18—A negative surge with $X$ and $A$ equal.

Fig. 19—A negative surge with $A$ and $X$ differing in length by 130 ft.

Fig. 20—Two positive surges 30 seconds apart when impressed overlap each other.

Fig. 21—Two negative surges impressed 25 seconds apart also overlap.

Fig. 22—Two records made of positive surges on the same plate at different times.

Fig. 23—Two negative surges taken two and one-half seconds apart on same plate.

voltage impressed. If the voltage is in the form of a surge—that is, unidirectional, either with a sheer front as indicated in Fig. 2(a), or tapered front, as in Fig. 2(b)—the figure on the photographic plate will differentiate between the tapered front and the abrupt front, and it will also indicate whether the surge was of positive or of negative polarity. Again, if the surge is alternating, as in Fig. 2(c), the figure will differentiate between it and the unidirectional surges. A wave with a 5-microsecond front requires five millionths of a second for the potential to rise to its full value. Expressed in terms of a traveling wave on a transmission line, this 5-microsecond front would represent a taper extending over one mile of transmission line. A wave with a 40-microsecond front would correspond to a taper of 40 miles on a transmission line. In case the potentials are higher than those represented by Figs. 10 and 11 a spark will occur and fog the plate. It is interesting to note that the positive and negative surges maintain a decided difference in appearance right up to the point where a spark occurs. Fig. 12 shows the klydonograph that was used in obtaining all of the figures shown and is a convenient form for certain kinds of laboratory work. It is not suitable, however, for graphic work. Figs. 13 (a) and (b) show network used in the laboratory and typical surge produced by it.

The diameters of the figures give a measure of the magnitude of the surges. The positive and negative figures have quite different calibrations, the figure for positive surge being considerably larger than that for the negative surge of the same magnitude. It is interesting to note that the calibration of an alternating voltage is identical with that of the positive surge and also that surges over a wide range of taper of fronts have the same calibrations. The calibration used consisted of two values—5-microsecond and 200-microsecond surges. In both of these cases the calibration is the same. It was not possible to check the calibration with an abrupt front as abruptness is a matter of degree. The figures shown and described as having an abrupt front were produced by a condenser discharged through a spark gap with no restraining network—that is, they were as abrupt as could be produced by ordinary methods. It is known, however, that it takes time for sphere spark gaps to break down and become highly conductive, and since sphere spark gaps were the quickest measuring devices available, it was felt that considerable error might be introduced by using them for measuring surges with sheer fronts. In fact, definite proof was obtained that they introduce a considerable error, as will be pointed out later.

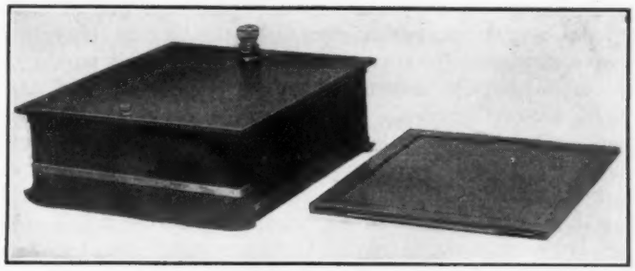


FIG. 24—A PRACTICAL RECORDING TYPE OF KLYDONOGRAPH

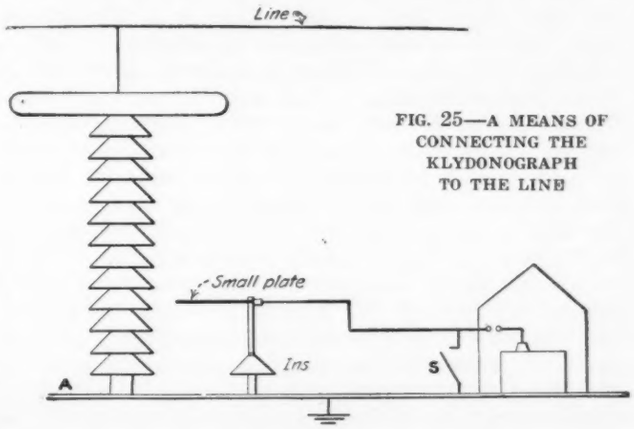



FIG. 25—A MEANS OF CONNECTING THE KLYDONOGRAPH TO THE LINE

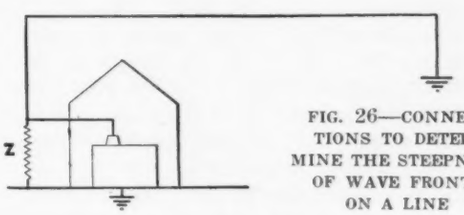



FIG. 26—CONNECTIONS TO DETERMINE THE STEEPNESS OF WAVE FRONTS ON A LINE

TABLE I.—RESULTS OF TESTS—POSITIVE SURGES

| Volts | Plate Number | Taper of Front, Microseconds | Radius of Figure, Mm. |
|---|---|---|---|
| 15,000 | 103 a | 200 | 19.0 |
| | b | 200 | 18.3 |
| | c | 200 | 19.0 |
| | d | 200 | 17.5 |
| | e | 200 | 17.5 |
| | f | 200 | 17.5 |
| | 115 a | 5 | 19.0 |
| | b | 5 | 17.5 |
| | c | 5 | 19.0 |
| | d | 5 | 19.0 |
| | e | 5 | 17.5 |
| | f | 5 | 19.0 |
| | 123 a | 200 | 20.0 |
| | b | 200 | 20.5 |
| | c | 200 | 20.5 |
| | d | 200 | 19.5 |
| | e | 200 | 20.0 |
| | f | 200 | 22.0 |
| | 216 a | 5 | 19.0 |
| | b | 5 | 19.0 |
| | c | 5 | 18.7 |
| | d | 5 | 20.0 |
| | e | 5 | 19.0 |
| | f | 5 | 20.0 |
| Average | | | 19.1 |
| 14,000 | 222 a | 5 | 17.5 |
| | b | 5 | 18.0 |
| | c | 5 | 17.0 |
| | d | 5 | 17.0 |
| | e | 5 | 18.2 |
| | f | 5 | 17.5 |
| Average | | | 17.5 |
| 12,000 | 221 a | 5 | 16.0 |
| | b | 5 | 16.2 |
| | c | 5 | 16.0 |
| | d | 5 | 16.2 |
| | e | 5 | 15.5 |
| | f | 5 | 16.2 |
| Average | | | 16.0 |
| 10,000 | 220 a | 5 | 13.5 |
| | b | 5 | 14.3 |
| | c | 5 | 13.2 |
| | d | 5 | 12.5 |
| | e | 5 | 13.0 |
| | f | 5 | 13.0 |
| Average | | | 13.3 |
| 9,000 | 107 a | 200 | 11.0 |
| | b | 200 | 12.7 |
| | c | 200 | 13.5 |
| | d | 200 | 12.7 |
| | e | 200 | 12.7 |
| | f | 200 | 14.0 |
| Volts | Plate Number | Taper of Front, Microseconds | Radius of Figure, Mm |
| | 165 a | 5 | 12.7 |
| | b | 5 | 12.7 |
| | c | 5 | 13.5 |
| | d | 5 | 13.5 |
| | e | 5 | 12.7 |
| | f | 5 | 15.8 |
| | 164 a | 5 | 14.0 |
| | b | 5 | 12.7 |
| | c | 5 | 13.5 |
| | d | 5 | 13.5 |
| | e | 5 | 13.5 |
| | f | 5 | 13.5 |
| Average | | | 13.2 |
| 6,000 | 109 a | 200 | 6.3 |
| | b | 200 | 7.1 |
| | c | 200 | 6.3 |
| | d | 200 | 6.3 |
| | e | 200 | 6.3 |
| | f | 200 | 7.1 |
| | 122 a | 5 | 9.5 |
| | b | 5 | 9.2 |
| | c | 5 | 7.1 |
| | d | 5 | 9.5 |
| | e | 5 | 8.0 |
| | f | 5 | 8.0 |
| Average | | | 7.6 |

It is not an easy matter to produce surges of definitely known characteristics. If the initial traveling wave produced by surges could be ignored, it would be a comparatively easy matter to produce surges of certain characteristics. But on account of the great quickness of this device the initial traveling wave could not be ignored. For instance, in the network represented by Fig. 13, with the condenser $C_s$ at the far end of the network eliminated, when the series spark gap sparks over, a wave travels from the spark gap through the series inductance and strikes the resistance at the end of the network, producing a reflection. This reflection may cause the voltage to go to double value, the excess voltage disappearing in an extremely short time in the form of an oscillation. Measurements made by spark gaps at this point did not indicate this adjusting oscillation, but the klydonograph did record it. By placing a condenser in parallel with this resistance a reflection occurs, but in this case it is a reflection of negative value; that is, the voltage is at the first instant reduced to zero, and the oscillation is that of bringing the voltage from zero up to the proper value. As the surges investigated had tapered fronts, the negative oscillation did not in any way interfere with the figures. Even with this condenser in parallel with the resistance, it is necessary to connect sufficient resistance in series with the klydonograph to damp critically the loop consisting of instrument leads between the ends of the condenser and the klydonograph. Without this series resistance the initial traveling wave would induce in this local loop a voltage with a sheer front which would be recorded by the klydonograph. A comparatively small resistance can be connected in series with the instrument that will prevent this induced oscillation and will still leave the circuit of such constants that it will record a surge lasting ten or fifteen billionths of a second.

In Tables I and II are given the results of some of the tests on which the calibration is based. Table I is for positive and Table II for negative surges. It should be noted that in this tabulation a rather severe test was imposed on the calibration. For instance, the network was not set up for one particular voltage and condition of surge and all points for the curve obtained, but instead a few surges were taken for a point on the curve, then the network was changed for some other point and later changed back to the first point, and so on, in that way including the errors of adjusting the network in the calibration of the camera. In spite of this task the data are quite consistent. The variations in this tabulation may be contributed partly to variations in setting of the spark gap and partly to variations in the method. In quite a few cases six surges were thrown on a plate simultaneously, and in practically every case it was impossible to measure any variations in the figures. In a few cases there were slight but measurable variations.

In order to check size of figures against time application of surges, several plates were made with one surge of a certain value thrown on terminal No. 1, two surges on No. 2, three surges on No. 3, and thus up to six surges on No. 6. It was found on measuring the diameter of the figures that repeated surges did not increase their dimensions but merely increased their intensity. Another test was made to determine the effect of humidity. Water-soaked waste was placed in the camera and left for half an hour, by which time the air had become saturated. Surges were then applied to the plate, and it was found that the figures were, as far as could be determined, exactly the same as for plates in ordinary atmosphere. In another test surges were thrown on a plate and the plate was left in the camera for fourteen hours and then developed. These figures were in every way normal, thus indicating that they do not disappear with time.

As previously pointed out, surges may be of extremely short duration, and although the tests so far indicate that the klydonograph is sufficiently rapid to record these short-time surges, tests were made to get a more concrete idea of the speed with which the figures are produced. In order to obtain these data the network indicated by Fig. 14 was used. This consisted of the simplest kind of surge generator, consisting of a condenser being discharged through a sphere gap into a resistance from which two aërial lines were carried. These lines, *A* and *X*, were made of different lengths and their terminals were connected to a special klydonograph having two terminals in contact with the emulsion of the photographic plate. These two terminals, instead of having point contacts, were made of disks approximately ⅜ in. in diameter, with their entire surface in contact with the emulsion. Evidence was obtained that sphere spark gaps were not quick enough to record transients of extremely short duration in the earlier tests on the network for calibration, so that spark gaps were eliminated from Fig. 14 except the one through which the condenser was discharged. The time lag of this gap played no part in the tests as data were desired only as regards the conditions after the gap had broken down. When the spark gap sparked

TABLE II.—RESULTS OF TESTS—NEGATIVE SURGES

| Volts | Plate Number | Taper of Front, Microseconds | Radius of Figure, Mm. |
|---|---|---|---|
| 15,000 | 102 a | 200 | 8.0 |
| | b | 200 | 7.3 |
| | c | 200 | 8.2 |
| | d | 200 | 8.0 |
| | e | 200 | 8.0 |
| | f | 200 | 7.6 |
| | 115 a | 5 | 8.0 |
| | b | 5 | 7.2 |
| | c | 5 | 7.6 |
| | d | 5 | 7.6 |
| | e | 5 | 7.2 |
| | f | 5 | 7.2 |
| | 123 a | 200 | 9.2 |
| | b | 200 | 8.7 |
| | c | 200 | 8.2 |
| | d | 200 | 8.0 |
| | e | 200 | 8.0 |
| | f | 200 | 8.7 |
| Average | | | 7.9 |

| Volts | Plate Number | Taper of Front, Microseconds | Radius of Figure, Mm. |
|---|---|---|---|
| 14,000 | 163 a | 5 | 6.7 |
| | b | 5 | 6.4 |
| | c | 5 | 7.1 |
| | d | 5 | 6.7 |
| | e | 5 | 7.1 |
| | f | 5 | 6.7 |
| Average | | | 6.8 |
| 12,000 | 126 a | 5 | 6.3 |
| | b | 5 | 6.3 |
| | c | 5 | 6.7 |
| | d | 5 | 6.3 |
| | e | 5 | 7.9 |
| | f | 5 | 6.4 |
| Average | | | 6.6 |

| Volts | Plate Number | Taper of Front, Microseconds | Radius of Figure, Mm. |
|---|---|---|---|
| 9,000 | 108 a | 200 | 5.1 |
| | b | 200 | 5.4 |
| | c | 200 | 4.0 |
| | d | 200 | 4.8 |
| | e | 200 | 5.2 |
| | f | 200 | 5.5 |
| | 166 a | 5 | 4.8 |
| | b | 5 | 6.3 |
| | c | 5 | 5.1 |
| | d | 5 | 5.1 |
| | e | 5 | 5.1 |
| | f | 5 | 5.5 |
| Average | | | 5.2 |
| 6,000 | 122 a | 5 | 3.0 |
| | b | 5 | 4.6 |
| | c | 5 | 4.5 |
| | d | 5 | 4.8 |
| | e | 5 | 3.8 |
| | f | 5 | 3.7 |
| Average | | | 4.1 |

over, the surge was thrown on leads $A$ and $X$ at the junction point simultaneously and surges traveled out over the two lines. The laws of traveling waves are well understood, so that their behavior can be accurately computed. Where $A$ and $X$ are of equal lengths, the surge being applied to both simultaneously, they should appear at the far end simultaneously. With the klydonograph connected between the far ends of these lines and ground the lines would have the characteristic of being open-circuited. When a surge traveling along a transmission line strikes an open end, a reflection occurs which theoretically reaches double value. In these tests the double value was obtained only when the lines were of considerable length. The reason for this is that when a spark gap sparks over it takes time for it to become highly conductive, and in consequence the voltage is applied somewhat gradually. If the time required for the spark gap to become highly conductive is appreciable, as compared to the time required for a wave to travel to the far end of the line and back again, the reflection at the far end will not be double the maximum value of the impressed surge. In making some of these tests $A$ and $X$ were of considerably different lengths, resulting in unequal reflection. In order to overcome this difficulty, resistances $R$, having values equal to the surge impedance of the lines, were connected between the lines and ground, thus eliminating reflections. It is interesting to note that voltages measured by means of sphere spark gaps at the far ends of these lines before the grounding impedance was added would not always indicate an increase in voltage due to reflection. On the longer lines where the reflected waves lasted an appreciable length of time the gap would indicate some increase in voltage, but not so great an increase as the klydonograph would indicate.

In Fig. 15 is shown a positive surge, where $A$ and $X$ are each 95 ft. long. The surges on the two lines, of course, started simultaneously, had the same distance to travel and arrived at the far end simultaneously. An interesting feature of this figure is the dividing line between $A$ and $X$. It should be noted that the lines emanating from the two terminals do not overlap but show a distinct dividing line half way between the two figures.

Fig. 16 is for a positive surge with $A = 30$ ft., $X = 50$ ft. The difference in the lengths equals 20 ft. From the propagation of a surge on an aërial line it is found that this difference of 20 ft. represents a difference in time of $2 \times 10^{-8}$, or twenty-billionths of a second. That is, the voltage on $A$ was applied twenty-billionths of a second earlier than on $X$, with the result that $A$ took possession of more than one-half of the space. Fig. 17 is for a positive surge, $A = 50$ ft., $X = 140$ ft., or a time difference of ninety-billionths of a second. Here $A$ is fully developed; thus it would appear that the positive figure becomes fully developed in something like a hundred-billionths of a second. Fig. 18 is a negative surge with $A$ and $X$ of equal length and the figures divide the space "fifty-fifty." Fig. 19 is a negative figure for a difference in lengths of 130 ft., giving a time differential of a hundred-and-thirty-billionths of a second. It should be noted that in Fig. 19 the division is appreciably shifted from the center line. Comparing Fig. 19 with Fig. 17, it will be seen that a negative figure develops very much slower than a positive figure. However, the tests indicate that either is quite fast enough for recording surges for practical purposes. The figures shown in the last few plates suggest that perhaps figures would not overlap, in which case if a surge were reported and in a comparatively short time another surge of the same or smaller magnitude appeared, the latter would not be recorded. Tests were made to determine whether this is actually the case.

In Fig. 22 one terminal was removed and a surge thrown on the remaining terminal; then the photographic plate was shifted and two and one-half minutes later another surge was thrown on the terminal in its new position. It is clear on this plate that figures do not interfere with recording of subsequent surges.

### Practical Application of Instrument

To be well suited for obtaining data on disturbances on transmission systems, a device should be continuously operative and should be capable of recording the exact time when a disturbance occurs. That is, it should be graphic. In many cases it is desirable to place the device where low-voltage electrical power is not available, in which case the device must be driven by clockwork.

Fig. 24 shows a klydonograph suitable for such application. This instrument makes use of a 10-in. x 12-in. photographic plate in a special plate holder. The moving parts are driven by a clock that makes one complete revolution in twenty-four hours.

Fig. 25 shows a suggested means of connecting the klydonograph to the line. Since this instrument is practically a zero current device, it is possible to connect it to the line electrostatically. This makes it possible to connect to a high-voltage line without introducing an insulation hazard. With the klydonograph connected as shown in Fig. 25, the figures produced give the magnitude and polarity of the surges.

Fig. 26 shows a means of connection that will give the steepness of the surge front. This consists of running counterpoise underneath or alongside the transmission line for 1,000 ft. to 2,000 ft., grounding the far end directly and grounding the near end through a high impedance. The klydonograph is then connected across this high impedance to ground. The voltage induced in the counterpoise is proportional to $di/dt$—that is, it is a measure of the steepness of the current wave, and since the current wave and the voltage wave of a surge have exactly the same shape, therefore it gives a measure of the steepness of the surge front. By comparing simultaneous readings on the klydonographs, one connected to the line through the electrostatic potentiometer and the other to the counterpoise, information concerning the surge can be obtained as regards magnitude, polarity, steepness of front and the direction in which the surge is traveling on the transmission line. Magnitude and polarity are obtained directly from the first klydonograph, steepness of front directly from the second, and the relative polarity of the two figures obtained gives the direction in which the surge is traveling. That is, if the polarity of the two figures is the same, the surge is of that polarity and is traveling in a direction fixed by the manner in which the recorders are connected to the system; if the figures are of different polarity, the surge is of the polarity indicated by the recorder connected to the potentiometer and is going in the opposite direction from the one previously mentioned. After the connections have been decided upon it is easy to determine the relation between figures and direction that surge is traveling.

The author wishes to express appreciation of the excellent assistance rendered by W. L. Teague in carrying out the development of the klydonograph.

# Who Sells Electrical Appliances?—VIII

## *Four Small Cities*

### "Electrical World" Survey of Retail Appliance Sales in Four Small Cities—Contractor-Dealers Doing Fair Share of Business—Central Stations Increasing Merchandising Activities

TO GAIN some idea of how the sales of electrical appliances in small cities and towns compare with those in the larger cities, four towns of 30,000 population and under were investigated. The conditions found to prevail in these towns, singly or collectively, are not intended to be taken as an indication of what may be expected the country over. In fact, widely different conditions were found in each place. Any unusual local situation, such as municipal plant competition with a privately owned central-station company, whether the central-station company was a straight electric or combination gas and electric utility, or the proximity of the town or city to a large city had a very marked effect upon retail appliance sales. It also affected the relative proportion of sales that were made by the different classes of dealers.

FOUR small cities and towns of 25,000 to 30,000 population and under are considered in this article. None of these towns was intentionally selected as representing an unusual situation which would affect appliance sales, the only consideration being that they were widely separated geographically. Particular attention is called to the fact that conditions existing in these four towns should not be taken as representative of other towns of the same size, as local conditions had a strong influence cn appliance sales.

In the next issue of the *Electrical World*, April 26, a summary and analysis of the volume and trend of retail electric appliance selling, together with a discussion of various factors affecting the business, will be published.

#### CITY "M"

Located in one of the North Central States, this city has a population of 25,000, and its principal industry is a large rolling mill. The surrounding country is given over to agriculture, the farms ranging in size from 40 to 160 acres. There was no department store, and the central-station company did an active merchandising as well as house-wiring business.

*Hardware Stores.*—Two hardware stores were carrying a fairly complete line of heating devices, and both sold washing machines. Neither dealer felt that the washing machine business was very profitable, but looked upon the small heating appliances as staple items, sales of which were growing steadily. A third hardware dealer who did not sell electric appliances said that he would not consider doing so until there was a sufficient demand to warrant his keeping a special man capable of making repairs.

*Furniture Stores.*—There were three furniture stores in this town, one of which sold washing machines and vacuum cleaners only. Sales were few and far between, and the owner was extremely apathetic concerning the possibility of increasing sales. He declared that the devices required too much high-pressure selling to be profitable. Store "D" was even less enthusiastic, carrying a line of vacuum cleaners of which only fifteen had been sold within the last year. Store "E" was a branch of a large housefurnishing organization with stores in a number of cities. Vacuum cleaners were sold incidentally, but a popular make of flatiron was sold at a reduced price of about 25 per cent. The manager here declared they were making some profit at this price, but the appliance was used entirely as a leader and for advertising purposes. He did not know, but presumed that the irons were purchased direct from the manufacturers.

*Contractor-Dealers.*—Three dealers were selling a fair volume of appliances. Dealer "F" was a partnership in which one of the owners handled the wiring business and the other the appliance business. Sales of both washing machines and vacuum cleaners, it will be noted, were very good, as one of the partners was devoting almost his entire time to selling the appliances. They also made it a practice to sell some appliances to customers for whom they were doing wiring. They offered no objection to the central-station company's merchandising nor to its house-wiring business. They did think, however, that discounts were short and complained of price cutting by the furniture stores.

*Specialty Store.*—One specialty shop, selling only washing machines and vacuum cleaners, had been operating for about nine months. The owner stated that business had been fairly satisfactory so far, and as he had a special agency agreement discounts were satisfactory. About one-fourth of his sales were made in rural territories to farmers. It is interesting to note in this connection that soon after this specialty store was opened another which had been operating in the town closed up because of lack of business.

*Central-Station Company.*—During the past year the local central-station company was rather inactive in its appliance selling. Most of its sales effort had been devoted to house wiring, but even so its appliance sales amounted to 32.5 per cent of the total. The company manager stated that plans were on foot for refurnishing the salesroom and putting on two additional outside salesmen. He thought that during the present year appliance sales by his company could be doubled.

It will be seen from the tabulation that contractor-dealers and the one specialty store are doing 44.1 per cent of the appliance business, which may be attributed to their closer acquaintance wth customers and the fact that they all appear to be alive to the possibilities of making sales when they are doing any kind of contracting work for customers. With the increased activity of the central-station company and the attitude of the local contractor-dealers, it is evident that these two classes of dealers will hold the majority of the appliance business.

SALES OF PRINCIPAL ELECTRICAL APPLIANCES, SHOWING QUANTITY, VALUE AND PROPORTION SOLD BY HARDWARE STORES, DEPARTMENT STORES, ELECTRICAL DEALERS AND THE CENTRAL-STATION COMPANY

CITY "M"

| Kind of Dealer | Washing Machines | Vacuum Cleaners | Ironers | Flatirons | Curling Irons | Toasters | Percolators | Total Sales Each Class of Store | Per Cent of Total for City |
|---|---|---|---|---|---|---|---|---|---|
| **Hardware Stores** | | | | | | | | | |
| Store "A" | 25 | ..... | ..... | 120 | 35 | 40 | 20 | | |
| Store "B" | 20 | ..... | ..... | 72 | 30 | 36 | 12 | | |
| Total | 45 | ..... | ..... | 192 | 66 | 76 | 32 | | |
| Value | $5,625 | ..... | ..... | $1,152 | $280 | $456 | $384 | $7,897 | 11.8 |
| Per cent of electric appliance sales | 71.3 | ..... | ..... | 14.6 | 3.5 | 5.8 | 4.8 | | |
| **Furniture Stores** | | | | | | | | | |
| Store "C" | 24 | 18 | ..... | ..... | ..... | ..... | ..... | | |
| Store "D" | ..... | 15 | ..... | ..... | ..... | ..... | ..... | | |
| Store "E" | ..... | 12 | ..... | 400 | ..... | ..... | ..... | | |
| Total | 24 | 45 | ..... | 400 | ..... | ..... | ..... | | |
| Value | $3,000 | $2,362 | ..... | $2,400 | ..... | ..... | ..... | $7,762 | 11.6 |
| Per cent of electric appliance sales | 38.6 | 30.4 | ..... | 31 | ..... | ..... | ..... | | |
| **Contractor-Dealers** | | | | | | | | | |
| Dealer "F" | 60 | 75 | ..... | 100 | 24 | 36 | 10 | | |
| Dealer "G" | ..... | ..... | ..... | 60 | 50 | 36 | 18 | | |
| Dealer "H" | ..... | ..... | ..... | 36 | ..... | 12 | ..... | | |
| Total | 60 | 75 | ..... | 196 | 74 | 84 | 28 | | |
| Value | $7,500 | $3,937 | ..... | $1,176 | $314 | $504 | $336 | $13,767 | 20.6 |
| Per cent of electric appliance sales | 54.6 | 28.6 | ..... | 8.5 | 2.3 | 3.6 | 2.4 | | |
| **Specialty Store** | | | | | | | | | |
| Store "I" | 100 | 60 | ..... | ..... | ..... | ..... | ..... | | |
| Value | $12,500 | $3,150 | ..... | ..... | ..... | ..... | ..... | | |
| Per cent of electric appliance sales | 79.9 | 20.1 | ..... | ..... | ..... | ..... | ..... | $15,650 | 23.5 |
| **Central-Station Company** | 36 | 230 | 2 | 300 | 300 | 225 | 30 | | |
| Total | 36 | 230 | 2 | 300 | 300 | 225 | 30 | | |
| Value | $4,500 | $12,075 | $300 | $1,800 | $1,275 | $1,350 | $360 | $21,660 | 32.5 |
| Per cent of electric appliance sales | 20.8 | 55.6 | 1.4 | 8.4 | 5.9 | 6.2 | 1.6 | | |
| **Grand Total** | | | | | | | | | |
| All dealers | 265 | 410 | 2 | 1,088 | 440 | 385 | 90 | | |
| Value | $33,125 | $21,523 | $300 | $6,528 | $1,870 | $2,310 | $1,080 | $66,736 | 100.0 |
| Per cent of total sales | 49.8 | 32.2 | .4 | 9.8 | 2.8 | 3.4 | 1.6 | | |

CITY "H"

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Hardware Stores** | | | | | | | | | |
| Store "A" | 36 | 40 | ..... | 140 | 48 | 24 | 20 | | |
| Store "B" | ..... | ..... | ..... | 48 | 25 | 18 | 8 | | |
| Total | 36 | 40 | ..... | 188 | 73 | 42 | 28 | | |
| Value | $4,500 | $2,100 | ..... | $1,128 | $310 | $252 | $336 | $8,626 | 9.4 |
| Per cent of electric appliance sales | 52.2 | 24.4 | ..... | 13.1 | 3.6 | 2.9 | 3.9 | | |
| **Electric Shop** | | | | | | | | | |
| Store "C" | 150 | 100 | ..... | 450 | 200 | 150 | 25 | | |
| Value | $18,750 | $5,250 | ..... | $2,700 | $850 | $900 | $300 | $28,750 | 31.3 |
| Per cent of electric appliance sales | 65.2 | 18.3 | ..... | 9.3 | 2.8 | 3.1 | 1.3 | | |
| **Contractor-Dealers** | | | | | | | | | |
| Dealer "D" | 48 | 60 | ..... | 220 | 100 | 50 | 24 | | |
| Dealer "E" | 3 | 6 | ..... | 125 | 25 | 18 | 6 | | |
| Dealer "F" | 40 | 75 | ..... | 72 | 24 | 18 | 8 | | |
| Dealer "G" | ..... | ..... | ..... | 48 | 12 | 6 | ..... | | |
| Dealer "H" | ..... | ..... | ..... | 36 | 15 | 10 | 3 | | |
| Total | 91 | 141 | ..... | 501 | 176 | 102 | 41 | | |
| Value | $11,375 | $7,402 | ..... | $3,006 | $748 | $612 | $492 | $23,635 | 25.7 |
| Per cent of electric appliance sales | 48.1 | 31.3 | ..... | 12.7 | 3.2 | 2.5 | 2.2 | | |
| **Department Stores** | | | | | | | | | |
| Store "I" | 36 | 200 | ..... | 300 | 144 | 60 | 24 | | |
| Store "J" | ..... | 150 | ..... | ..... | ..... | ..... | ..... | | |
| Total | 36 | 350 | ..... | 300 | 144 | 60 | 24 | | |
| Value | $4,500 | $18,375 | ..... | $1,800 | $612 | $360 | $288 | $25,935 | 28.2 |
| Per cent of electric appliance sales | 17.4 | 70.9 | ..... | 6.9 | 2.3 | 1.4 | 1.1 | | |
| **Central-Station Company** | 15 | 24 | ..... | 150 | 36 | 48 | 12 | | |
| Value | $1,875 | $1,260 | ..... | $900 | $153 | $288 | $144 | $4,620 | 5.4 |
| Per cent of electric appliance sales | 40.5 | 27.3 | ..... | 19.5 | 3.4 | 6.2 | 3.1 | | |
| **Grand Total** | | | | | | | | | |
| All dealers | 328 | 655 | ..... | 1,589 | 629 | 402 | 130 | | |
| Value | $41,000 | $34,387 | ..... | $9,534 | $2,673 | $2,412 | $1,560 | $91,566 | 100.0 |
| Per cent of total sales | 44.8 | 37.5 | ..... | 10.5 | 2.9 | 2.6 | 1.7 | | |

## CITY "H"

This city of approximately 30,000 was situated in a rich agricultural section in one of the Eastern states. There is a total of about six thousand residential meters in the city, which is supplied by a municipal plant and a privately owned company. About three-fifths of the customers take energy from the municipal plant, while the remaining two-fifths are customers of the privately owned company. Both companies sell lamps, while the private company maintains only a small appliance display. There has been considerable agitation regarding the municipal plant, and the manager of the privately owned company has up to the present time refrained from active merchandising.

*Hardware Stores.*—Two hardware stores were selling electrical appliances, store "A" being a jobber and retailer. The owner of this store said that he had a very satisfactory arrangement with one of the well-known manufacturers of electrical appliances and that the business was proving profitable to him. Sales of washing machines and vacuum cleaners were made on deferred payments, which the company was financing itself. He declared, however, that the average hardware dealer did not favor this class of business and preferred handling smaller appliances, which were mostly cash sales.

Hardware dealer "B" sold only heating appliances, which, he said, were moving evenly the year around.

SALES OF PRINCIPAL ELECTRICAL APPLIANCES, SHOWING QUANTITY, VALUE AND PROPORTION SOLD BY HARDWARE STORES DEPARTMENT STORES, ELECTRICAL DEALERS AND THE CENTRAL-STATION COMPANY

CITY "N"

| Kind of Dealer | Washing Machines | Vacuum Cleaners | Ironers | Flatirons | Curling Irons | Toasters | Percolators | Total Sales Each Class of Store | Per Cent of Total for City |
|---|---|---|---|---|---|---|---|---|---|
| **Hardware Stores** | | | | | | | | | |
| Store "A" | ..... | ..... | ..... | 144 | 36 | 48 | 18 | | |
| Value | ..... | ..... | ..... | $864 | $153 | $288 | $216 | $1,521 | 2.1 |
| Per cent of electric appliance sales | ..... | ..... | ..... | 56.8 | 10 | 18.9 | 14.3 | | |
| **Contractor-Dealers** | | | | | | | | | |
| Dealer "B" | 12 | 18 | ..... | 75 | 24 | 20 | 6 | | |
| Dealer "C" | 65 | 70 | ..... | 48 | 36 | 30 | 10 | | |
| Dealer "D" | 15 | 18 | ..... | 36 | 30 | 24 | 6 | | |
| Dealer "E" | 4 | 6 | ..... | 40 | ..... | 18 | ..... | | |
| Dealer "F" | 76 | 100 | ..... | 60 | ..... | 48 | 30 | | |
| Total | 172 | 214 | ..... | 259 | 90 | 140 | 52 | | |
| Value | $21,501 | 11,735 | ..... | $1,554 | $382 | $840 | $624 | $36,135 | 47.9 |
| Per cent of electric appliance sales | 59.5 | 31.2 | ..... | 4.3 | 1.0 | 2.3 | 1.7 | | |
| **Department Stores** | | | | | | | | | |
| Store "G" | 48 | 60 | ..... | ..... | ..... | ..... | ..... | | |
| Store "H" | ..... | ..... | ..... | 72 | 80 | 48 | 30 | | |
| Total | 48 | 60 | | 72 | 80 | 48 | 30 | | |
| Value | $6,000 | $3,150 | ..... | $432 | $340 | $289 | $360 | $10,570 | 14.4 |
| Per cent of electric appliance sales | 56.9 | 29.9 | ..... | 4.0 | 3.2 | 2.6 | 3.4 | | |
| **Central-Station Company** | 154 | 79 | 3 | 284 | 25 | 58 | 11 | | |
| Value | $19,250 | 4,147 | $450 | $1,704 | $106 | $348 | $132 | $26,136 | 35.6 |
| Per cent of electric appliance sales | 73.7 | 15.8 | 1.7 | 6.6 | 0.4 | 1.3 | 0.5 | | |
| **Grand Total** | | | | | | | | | |
| All dealers | 374 | 353 | 3 | 687 | 151 | 294 | 121 | | |
| Value | $46,750 | $18,532 | $450 | $4,554 | $980 | $1,764 | $1,332 | $74,362 | 100.0 |
| Per cent of total sales | 62.8 | 24.9 | 0.6 | 6.1 | 1.4 | 2.4 | 1.8 | | |

CITY "C"

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Contractor-Dealer** | | | | | | | | | |
| Dealer "A" | 4 | 7 | ..... | 24 | 15 | 6 | 3 | | |
| Dealer "B" | 6 | 6 | ..... | 30 | 8 | 10 | 5 | | |
| Total | 10 | 13 | | 54 | 23 | 16 | 8 | | |
| Value | $1,250 | $682 | ..... | $324 | $98 | $96 | $96 | $2,546 | 17.4 |
| Per cent of electric appliance sales | 49.1 | 26.9 | ..... | 12.8 | 3.8 | 3.7 | 3.7 | | |
| **Hardware Store** | ..... | ..... | ..... | 36 | 12 | 6 | ..... | | |
| Value | ..... | ..... | ..... | $216 | $51 | $36 | ..... | $303 | 2.1 |
| Per cent of electric appliance sales | ..... | ..... | ..... | 71.3 | 16.8 | 11.9 | ..... | | |
| **Central-Station Company** | 47 | 48 | 3 | 223 | 25 | 24 | 12 | | |
| Value | $6,875 | $2,520 | $450 | $1,338 | $106 | $144 | $144 | $11,577 | 80.5 |
| Per cent of electric appliance sales | 59.4 | 21.8 | 3.9 | 11.6 | .9 | 1.2 | 1.2 | | |
| **Grand Total** | | | | | | | | | |
| All dealers | 57 | 61 | 3 | 313 | 60 | 46 | 20 | | |
| Total | $8,125 | $3,202 | $450 | $1,878 | $255 | $276 | $240 | $14,426 | 100.0 |
| Per cent of total sales | 56.3 | 22.2 | 3.2 | 1.3 | 1.7 | 1.9 | 1.7 | | |

Purchases were made from a hardware jobber, on which he received discounts of 35 to 40 per cent. These in his estimation were satisfactory.

*Electric Shop.*—Store "D" was a typical electric shop selling appliances, portable lamps, fixtures and some radio equipment. The owner had been in business in the city for fourteen years and said that he knew almost every one in the town. He employed one outside salesman and did a considerable amount of newspaper and direct-by-mail advertising. Larger appliances were sold on deferred-payment plan, financed through a local bank. The owner expressed dissatisfaction with the discounts on larger appliances, because, he said, the cost of advertising and selling is too great. Although up to this year he had not done any contracting work, he has changed this policy and is now doing a considerable amount of wiring, which he says will have a tendency to balance and diversify his business.

*Contractor-Dealers.*—Dealer "D" had a well-located store on the main street of the town, and was doing a very fair appliance business in connection with house wiring. The owner said that most of the sales of larger appliances were made by himself, frequently when he was estimating a wiring job for a customer. He thought that the appliance business paid him sufficent profit to take care of his office expense, not including rent. He was rather vague as to the amount of profit he was making, but felt that discounts were not so much as they should be. He did considerable shopping around among jobbers and manufacturers to obtain the best prices. Dealer "F" had a manufacturers' agency for a line of washing machines and vacuum cleaners, which were being sold by a man on a straight commission basis. Sales were financed through a finance corporation, and the owner expressed himself as satisfied with the margin of profit as he was receiving a discount of 45 per cent on these two devices. Heating-appliance sales were incidental.

Dealers "E," "G" and "H" were essentially wiring contractors and were little interested in the appliance business. Discounts, they said, were not sufficient to cover additional selling expense, and, furthermore, they felt that they could not meet competition of other dealers who were employing outside men.

*Department Stores.*—Department store "I" was doing a very satisfactory appliance business, vacuum cleaners being sold under a resale agreement. The manager of the house-furnishing department said that the store had decided to carry three well-known makes of appliances for which there was a good voluntary demand. All purchases were made direct from manufacturers, and discounts were ample. All appliance sales, except those of vacuum cleaners, were made by persons coming into the store.

*The Central-Station Company.*—The manager of the privately owned central-station company said that it had been the policy to leave the appliance business almost entirely to other dealers. Because of the municipal plant competition it was felt that this was a wise policy. However, it has not worked out so well as expected,

and the company is planning to equip a display room and put on an active selling organization. At present the appliance display is in the street-railway waiting room. About half the total sales were made around Christmas time, when extra effort was put forth. The company plans to concentrate much of its effort on the sale of domestic refrigerators, electric ranges, washing machines and vacuum cleaners, particularly in pioneering the first two devices, as the manager believes that the time is ripe to develop these loads among residential customers.

### CITY "C"

With a population of a little more than 10,000, this town may be termed a typical county seat of a farming community. There is very little industrial activity. Electric service is supplied from transmission lines of a central-station company which maintains a district office and salesroom on the square. The local district manager handles the merchandising business and personally makes about one-half of the sales, as he is well acquainted in the town. A special washing-machine and vacuum-cleaner salesman occasionally spends a week or ten days closing up prospects which have been developed by canvassing and direct-by-mail advertising. The central-station company, it will be seen, does about 80 per cent of the business, and its relations with the two contractor-dealers appear to be very good. It throws a considerable amount of wiring and contracting work to them, and they are satisfied to handle this business and leave most of the appliance business to the company.

Both contractor-dealers carry small stocks of appliances, and most of their sales are made to customers for whom they are doing wiring. It is all on a cash or thirty-day basis, and neither of the contractors was inclined to increase his appliance business, as they felt that to do so it would be necessary for them to neglect their other work. The margin of profit on appliances was not sufficient, they said, to induce them to put forth any more efforts.

The one hardware store, which sold electrical appliances, had not been doing a great amount of business. However, the owner said that this year the sales were much better than formerly, and he was inclined to add to his stock and give more attention to his displays of electrical appliances.

The district manager of the central-station company said that during the last year appliance sales had not received so much attention as they should have had, but that one man is to give his entire attention to merchandising, and from the increase in sales during the first two months of the present year he expects at least to double the volume of sales. Special attention is to be given the development of domestic refrigerating and electric range business. While the central-station company here will no doubt increase appliance business very materially, there is little doubt that this will be reflected in better business for other dealers.

### CITY "N"

This town of 32,000 population is situated in a highly developed industrial area while at the same time there is a considerable amount of agriculture carried on in the surrounding territory. It is within commuting distance of a large city where a great amount of shopping is done. Electrical dealers of all classes declared that this fact has a very appreciable effect in lessening appliance sales. There were no large department stores in the town, and the central-station company was a combination gas and electric property directing most of its sales effort toward developing the gas business.

*Hardware Stores.*—One hardware dealer was carrying a line of standard appliances selling at list prices. No large devices were handled as the owner said he did not want to sell merchandise on the installment-payment basis. Electric heating devices he had found were profitable, discounts fair and the business generally desirable. His purchases were made through hardware jobbers at prices giving a spread which was comparable to that on other items of hardware.

*Contractor-Dealers.*—Dealers "B," "D" and "E" were primarily in the wiring business, the sale of appliances being entirely incidental. All declared that they made no money out of the sale of electrical devices, dealer "B" wishing that he was out of it as the amount of servicing he was called upon to do gratuitously ate up all possible profits. He did a considerable amount of industrial contracting, and when his customers called upon him to service their household devices he felt that he could not refuse. Contractor-dealer "D" did a large wiring and fixture business and sold appliances "if a customer wanted them." He was pushing radio sales, but was little interested in the possibility of increasing his appliance business. Dealer "E" had the best location in town with the least attractive store. Appliances were sold only when customers asked for them—washing machines and vacuum cleaners being ordered one or two at a time from a nearby jobber. "The appliance business don't amount to nothin'," he said.

Dealer "C" was pushing his appliance business with an outside salesman. He was also doing a considerable volume on radio and contracting. He believed there is a good opportunity for profit from appliance sales if the dealer buys "right." His purchases were made from both jobbers and manufacturers and he requires a spread of at least 35 per cent on all appliances. Commenting on the appliance business, he said that the chief trouble with it is that it is not "out of its swaddling clothes." There are few definite trade customs to guide the dealer, and profit is lessened by the fact that a large volume of the total business is from the sale of specialty items such as washing machines and vacuum cleaners requiring expensive selling methods. The business needs to become stabilized, and there should be a wider variety of staple articles.

Contractor dealer "F" was also a plumber. He declared flatly that there was no money in the small devices and that the large appliances were only fairly profitable. One outside salesman was employed. In his opinion too many people are trying to be contractors and dealers who should be working for some one else. They have not the capital or financial backing successfully to carry on a merchandising business and in times of stress are inclined to cut prices to obtain ready cash.

*Department Stores.*—Of the two department stores one sold only washers and vacuum cleaners because, the owner said, the installment-payment business fitted in nicely with his furniture sales. All purchases were made direct from manufacturers at satisfactory discounts. The other store, "H," carried only the smaller heating appliances, for which the proprietor declared there was a moderate demand. He said that all of the residents of the town did some of their shopping in the large city and local dealers had this competition to meet in all lines of merchandising.

*Central-Station Company.*—Appliance sales by the central-station company were not so great as they

should be, the general manager said, because the company had until recently concentrated most of its efforts on the gas business. This practice is being changed because he believes that a more active merchandising effort will result in more intimate contact and better relations with customers. He declared that the use of appliances has been the greatest single cause of a very noticeable decrease in the number of complaints concerning high bills, and for this reason alone, if for no other, he is putting more effort into his merchandising business. He thought that the short discounts on electric appliances were holding back sales and compared these discounts particularly with those on gas ranges, which, he said, are generally 10 to 15 per cent greater, allowing a spread of at least 50 per cent. This he said is sufficient to cover sales and advertising cost with a little left over for profit. He is planning not only to extend his merchandising efforts within the city, but also has under consideration a program of intensive selling to increase the use of appliances by rural customers. This includes the development of electric range sales in districts not supplied with gas.

### CONCLUSION

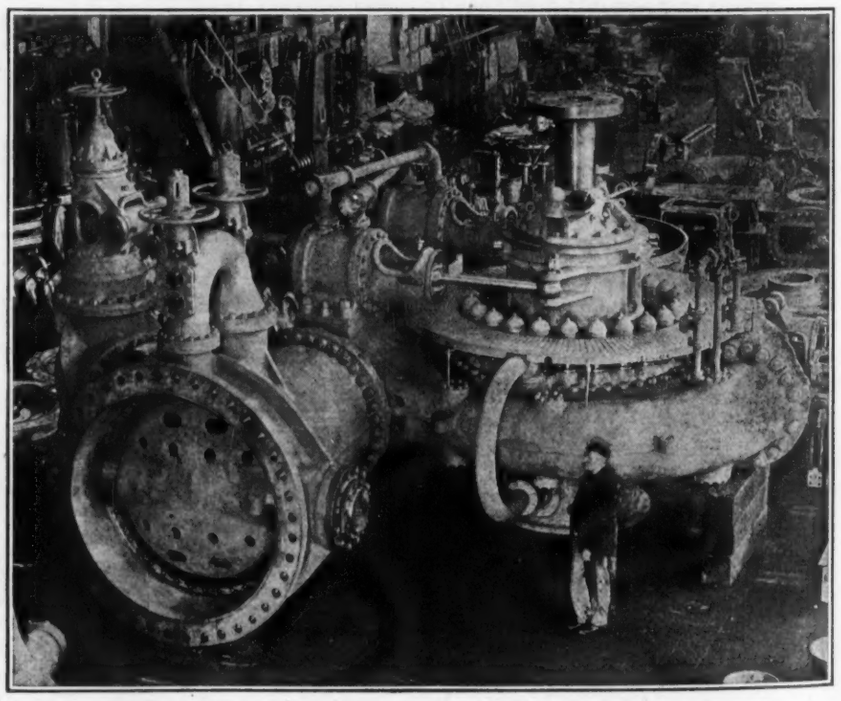
Looking at conditions in the four cities, there are two outstanding facts. One is that in the smaller towns the contractor-dealer appears to be a substantial citizen who handles his appliance sales rationally without expecting them to carry his entire business as do a certain class of contractor-dealers in the larger cities. Moreover, there is less animosity between the contractor-dealer and the central-station company; in fact, they were found for the most part to be on very friendly terms. This is no doubt due to the fact that in the smaller community they have a better opportunity to become acquainted with each other. The other feature of the appliance business in small towns is the very marked tendency on the part of the central-station company to increase its appliance sales generally, and most particularly the interest it is displaying in the development of the refrigerator and electric range business. All of the central-station managers interviewed declared that it is to their best interest, from a public relations viewpoint, either to continue or expand their appliance sales departments. They feel that no other class of dealer has the same interest as they in developing the residential load, and in the proposed missionary work which has been started on the domestic refrigerator and electric range is seen the recognition of the fact that the central-station company must do this pioneering work.

None of the central-station managers is conducting his merchandising departments on a cut-price basis for the purpose of load building regardless of possible profit from sales. They reason that the business can be conducted at least on a self-supporting basis, that it should show a profit, and that increased consumption and revenue will follow as a natural consequence if the volume of sales is increased. All of them were enthusiastic in encouraging other dealers, both electrical and non-electrical, to sell electrical appliances; but they did not believe that they could afford to stand idly by and permit the business to develop of its own accord, with the danger of many inferior appliances being sold and the possibility that only the devices selling for a comparatively higher price would be pushed by the average dealer. Central-station managers said that while the other merchants might be selling satisfactory numbers of washers and vacuum cleaners, they are not so much interested in the small appliances or in developing new ones, and for that reason alone central-station companies should maintain a dominant position in appliance selling.

## A Correction

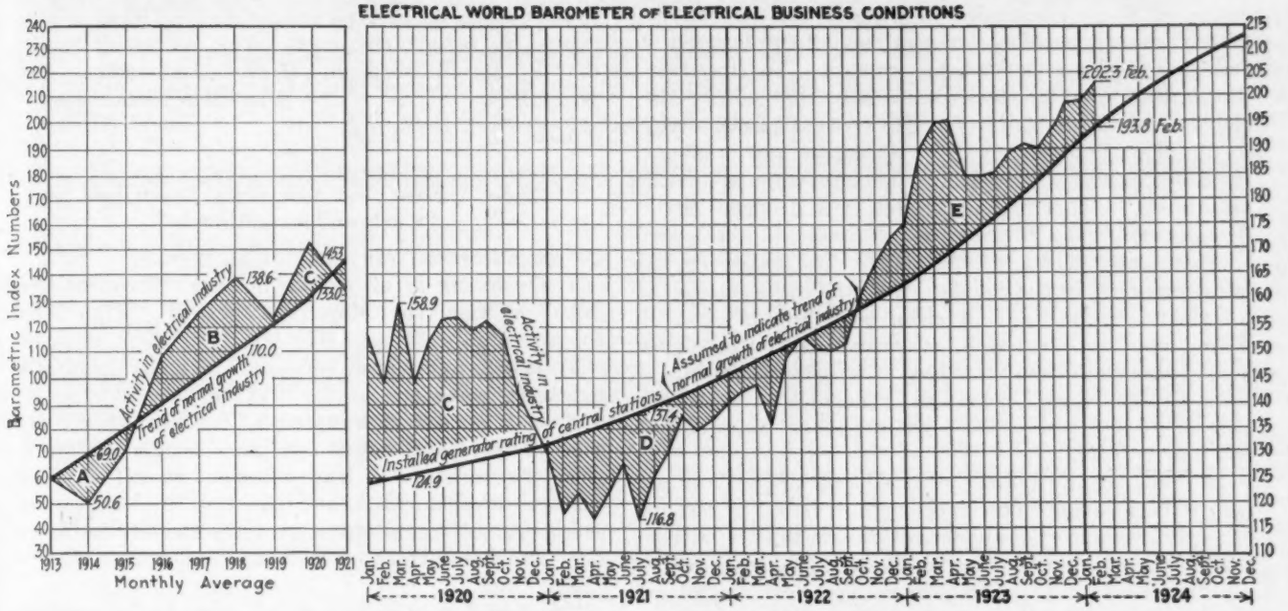
IN THE recent suit filed by the government with reference to the administration of "Mazda" lamp patents, the defendants, aside from the General Electric Company, are the Westinghouse Lamp Company and its parent, the Westinghouse Electric & Manufacturing Company, and not the other licensees of the General Electric Company, as was stated in error in an editorial in this paper on April 5. The latter licensees state that the General Electric Company has no control over the resale methods and prices of licensees other than the Westinghouse company.

## Highest Head Reaction Turbine Completed



THE illustration shows the 35,000-hp. turbine for the Oak Grove development of the Portland (Ore.) Railway, Light & Power Company completely assembled just before it recently left the factory of the Pelton Water Wheel Company at San Francisco. This is the highest head reaction turbine ever built. It will operate under an average effective head of 860 ft. at 514 r.p.m., driving a 25,000-kva. vertical generator. This initial unit at the Oak Grove station will cost more than $3,000,000. Installation work is now in progress. The ultimate capacity of the station will be 75,000 kva.

# February Business Activity 8.5 per Cent Above Normal




FIGURES on which the "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" are based indicate that activity within the industry was slightly greater than during January. Some of the basic industries showed activity under January, but the general tendency was upward.

An increase of 3.7 points on the barometer scale as compared with January is shown. During this interval the industry has grown 2.0 points, leaving a net increase in activities of 1.7 points on the barometer scale as compared with January. The electrical industry as a whole was operating in February at 8.5 points or per cent above what would have been the point of seasonal demand if growth in the industry had been normal. In January (revised) it was operating at 6.8 points or per cent above the point of normal demand.

## Letters from Our Readers

**A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute**

### Insurance of Electrical Machinery

*To the Editors of the* ELECTRICAL WORLD:

The article entitled "Electric Machinery Insurance" on page 423 of the issue of the ELECTRICAL WORLD for March 1 indicates that the rules and rates of the Steam Boiler and Flywheel Service Bureau are binding upon all member companies. The word "member" actually qualifies the intention, but to the average reader it would seem that the bureau controls the rules and rates of all companies. I believe there are a number of companies that are not members of the bureau and that will not, therefore, be bound by the bureau.

So far as I am informed, the Royal Indemnity Company, which originated electrical machinery insurance in the United States, and the Eagle Indemnity Company are the only ones which provide testing service instead of inspection service. These two companies provide each of their field-testing engineers with the following equipment: Megohm meters, voltmeters, and ammeters (all ranges alternating and direct current), Wheatstone bridges, instrument transformers, transformer oil testers, air-gap gages, especially built "temperature-indicating" devices and other equipment. The testing engineers are required to make exhaustive tests on each and every piece of equipment, not less often than quarterly, whether the equipment be rotating or non-rotating. For the protection of the insurance company such tests, unfortunately, cannot always be confined to the machinery insured.

The article is correct, though slightly misleading, where it states that electric lamps, heating elements, etc., are not insurable. While these are not insurable, they are, nevertheless, "covered." To illustrate: A motor was operating a lifting magnet. The shaft of the motor broke. The magnet dropped in such manner as to damage itself and, in addition, damage an automobile truck. In this instance the motor was the only device mentioned in the policy, nevertheless under the policy terms the insuring company was required to pay (a) damage to the motor itself, (b) damage to the lifting magnet, and (c) damage to the automobile truck. The latter was not the property of the insured.

Under item 5 of "Exclusions" the words "or other object" cannot properly appear, for there are no "other objects" in the policy; all objects or devices, regardless of what they may be, are "machines," as indicated by the definition of "machine."

There is no clause in our policies nor in the policies of the Eagle which "requires the saving of machinery for inspection of the damage for adjustment." Such a clause is unnecessary and, in addition, would defeat our original intention that the insured, in the event of breakdown, should not be placed at a disadvantage by having to delay commencement of repairs.

The word "accident" appears in paragraph 4 of the first page and is described in several competitors' policies, but the word does not appear in the policies of the Royal or the Eagle. These two companies insure

against "breakdown," which includes not only "accident," but probably malicious intent, and it is the desire of these companies to protect the insured not merely against accident but against willful destruction caused by means beyond his control. To illustrate: The largest crucible-steel company in the country discharged an electrician. The electrician gained access to the plant immediately after discharge and is alleged to have literally "dropped a monkeywrench in the machinery." This monkeywrench was dropped into a transformer, and a combination of circumstances caused a considerable wreck of the plant. The employee has been convicted in the courts. It is the intention of the Royal and of the Eagle to cover such losses.

An important feature of electrical insurance policies has, I believe, been omitted from your article. I refer to the "legal" coverage. There is at least one case of record where the legal expenses exceeded the cost for repairs.

To some of the public utilities and large manufacturers the insurance described in your article is perhaps less attractive from the indemnity angle than it is from the "financing" angle. Financiers are apparently realizing the advisability of requiring electrical machinery insurance much in the same manner and for the same reason as they have generally required fire insurance and other coverage which might affect the finances of the borrower.

WARREN HILLEARY,
Superintendent Schedule Rating Deparment.
Royal Indemnity Company,
New York, N. Y.

## Mathematicians Need Help

*To the Editors of the* ELECTRICAL WORLD:

A sharp rise in the cost of living during the war and after has caused financial difficulties to a number of scientific societies, among others to the American Mathematical Society. These difficulties have been increased by the virtual collapse of some similar organizations in Europe, making it almost necessary to publish their prominent contributions in the *Transactions* of the American Mathematical Society. This society is now trying to collect an endowment of at least one hundred thousand dollars, the income from which is to help to take care of its publications. The membership largely consists of teachers with limited incomes so that it is not practicable to increase the dues. Being good at figures has helped some persons in this country to gather large fortunes, but the mathematical fraternity as a whole uses algebraic symbols in which there seems to be no money.

The engineering profession particularly, and through it the whole country, has been benefited to a considerable extent by the labors of mathematicians of past generations. Not to speak of elementary mathematics, without which engineering would still be in the dark ages, we are using calculus, analytics, theory of probabilities, determinants, hyperbolic functions, vector analysis, complex quantities, theory of finite differences, etc., and the scope of practical application of mathematics increases every year with the advance in the engineering art and physics. Moreover, some of us are under direct obligation to our mathematical friends for being helped out of our particular difficulties.

It seems therefore only just that at least part of the proposed endowment should come from engineers and from industrial enterprises with which they are connected and which have been directly benefited by the present development of mathematics. The plight of the society is such that they have to have their *Transactions* set in type and printed in Hamburg, Germany, to reduce the cost. The secretary is Prof. R. G. D. Richardson, Brown University, Providence, R. I.

VLADIMIR KARAPETOFF,
Cornell University. College of Engineering.
Ithaca, N. Y.

## "S&C" Fuse Not Correctly Described as "Carbon-Tetrachloride"

*To the Editors of the* ELECTRICAL WORLD:

The wording of an article in your "Business Conditions" section for March 1, headed "High-Tension Fuses and Lightning Arresters Active," is misleading and we believe deserves correction. In the opening sentence the reference to the "carbon-tetrachloride" type of fuse is an error in statement. Although the liquid used in the "S&C" fuse is a chlorine derivative, it is altogether misleading and incorrect to refer to it as "carbon-tetrachloride," and we have been going to a great deal of trouble to correct the use of the description "carbon-tetrachloride" in connection with the "S&C" fuse.

The liquid used in the "S&C" fuse has a number of important advantages over carbon-tetrachloride. Among them is the lower freezing point. The "S&C" fuse liquid has a freezing point of 70 deg. below zero F., whereas carbon-tetrachloride freezes at about 10 deg. below zero F. The correct name for the fuse is the trade name "S&C" fuse, as it is generally known.

The expression that "one manufacturer has recently doubled his factory floor space" would imply that others are manufacturing this type of fuse. The manufacture of the "S&C" fuse is controlled by United States and foreign patents, and it is manufactured in the United States only by Schweitzer & Conrad, Inc., Chicago, and in Canada and Great Britain by our licensees.

J. B. ADAMS,
Schweitzer & Conrad, Inc., Sales Manager.
Chicago, Ill.

## Why Should Not the Registration of Engineers Be Reciprocal as Between States?

*To the Editors of the* ELECTRICAL WORLD:

Here is a subject where a little publicity might make things much easier for the practicing engineer by bringing about a change that will not come until it is forced by public opinion.

Recently I had occasion to move from one state in which I had a license to practice engineering to another in which licenses were also required, but which did not have reciprocal registration arrangements with the first state. The upshot was a delay of more than four months during which I could not practice in this second state. The authorities absolutely prohibited it until the whole process had been gone over again. It seems to be the Eastern States which cause this situation. The Middle Western States and some of those still further west have reciprocal arrangements, so that a notice from the board of the engineer's home state to the board of the other state in which he wishes to practice secures him the right immediately. It would cost about $700 for an engineer to get licenses permitting him to practice anywhere in the United States, to say nothing of the time he would lose while waiting for them.

PAUL O. RYAN,
Ann Arbor, Mich. Registered Professional Engineer.

# Central Station and Industrial Practice

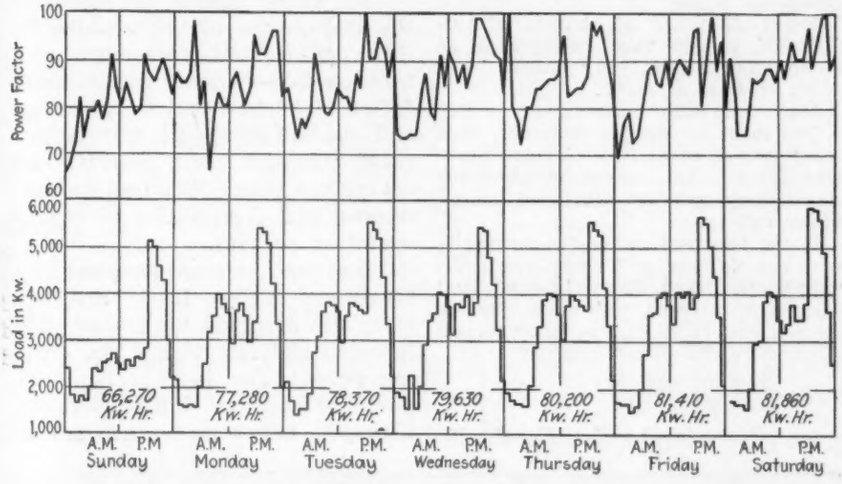
**Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants**

## Power-Factor Survey of Generating Plants

By Frederick Krug

Superintendent of Hydro-Electric Plants, Porto Rico Railway, Light & Power Company, Bayamon, Porto Rico

AS A PRELIMINARY to a power-factor survey of the system which was to be undertaken if the data obtained indicated the necessity for it, the power factor at the generating plants as obtained every hour for a week was carefully plotted against the loads for the corresponding period by the Porto Rico Railway, Light & Power Company. This company operates two hydro-electric plants which supply the main load center over a 16-mile transmission line. An auxiliary steam plant is also connected to the system, but this is placed in operation only during periods of low water, the hydro-electric plants having ample capacity for present load conditions. At the time these data were obtained the hydro-electric plants were supplying the entire load and the number of generating units in service varied from two to six.




METHOD OF MAKING POWER-FACTOR SURVEY OF WATER-POWER SYSTEM

The power factor as obtained for each hour of the week was calculated from the current and voltage readings of the units in service and the indicated kilowatt load. This method was considered more accurate than taking directly the power factor indicated by the board instruments. The sum of the indicated kilowatt load of machines in service was divided by the sum of the calculated kilovolt-ampere load and the result obtained was taken as the power factor of generating plants. Since the power factor of the various units in service varied by only a few per cent, the error introduced by taking the arithmetical rather than the vector sum of the kilovolt-ampere loads was considered negligible.

The power factor for each hour was then carefully plotted and the total kilowatt load as obtained from integrating watt-hour meter readings plotted to the same scale of time to permit of ready comparison. The result is shown in the accompanying illustration. It was at once apparent that the power factor was not nearly so bad as anticipated. The low power factor at night was to be expected because of the large amount of inductive apparatus in circuit with little load.

The improvement of power factor with day load toward the end of the week was in part due to more careful adjustment of the excitation of three synchronous motors that are used to drive direct-current generators for street-car service at the load end of the transmission line.

Since one of the heaviest induction motor loads, a pumping station, will be converted to a gravity system within a year, a further improvement of power factor is expected, because any new power customer of similar size would be required to install synchronous or other power-factor-correcting motors. Further than this, the company will install one or two additional motor-generator sets in the near future in connection with which due attention will be given to sufficient excess capacity to maintain an average daily power factor of 90 per cent on the system.

Closer attention has been directed to the proper excitation of the synchronous motors since this test was made with the result that a considerable improvement in power factor and voltage regulation has been noted.

## Transmission-Line Sag and Span Curves

By E. G. Allen

Consulting Engineer
Stone & Webster, Inc., Boston

THE usual method employed to determine the sags and tensions in transmission-line spans is by the intersection of two series of curves, one of which represents the relationship between tension and sag under constant loading and the other at constant temperature. These curves are shown in the accompanying illustration. The following presents what is believed to be the simplified form of this method by which these computations may be made in office routine:

*"Loading" Curves (at constant temperature)*:

The method is based on the formula:

$$T_1 - T = \left(\frac{8M^2a}{3S^2}\right) d_1^2 + MaE\ (t - t_1) - \left(\frac{8Ma}{3S^2}\right) d^2,$$

where $S$ = span in feet,
$T$ = tension (pounds per wire),
$W$ = weight (pounds per foot),
$d$ = deflection at center of span in feet,
$t$ = temperature,
$M$ = modulus of elasticity,
$a$ = area of wire in square inches,
$E$ = coefficient of expansion.

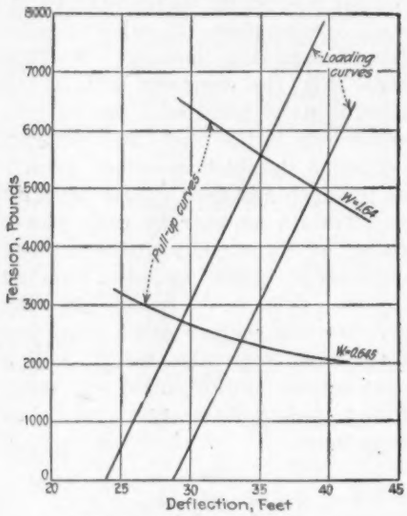
*See Pender's Handbook.

Subscript 1 refers to conditions specified—usually of maximum loading.

$$\text{Let } K = \frac{8Ma}{3S^2}.$$

1. For the initial curve (through point $T_1d_1$) $t—t_1 = 0$ and the second term of the second member disappears.
2. If $d = 0$, $T_1—T_0 = Kd_1^2 = C_1$.
3. For any other value of $d$, $T_1—T_0 = C_1 - Kd^2$.
4. For any other value of $t_1$, $T—T_1$ is increased, at the same deflection, by $MaE(t—t_1)$.

*Example.*—Find the tensions and deflections for a 1,000-ft. span of No. 4/0




STRESS DEFLECTION DIAGRAM

B. & S. hard-drawn copper, maximum tension 35,000 lb. per square inch, with ½-in. ice and 8 lb. wind at 0 deg. F.

$a = 0.166$, area of wire,
$d = 0.530$, diameter of wire,
weight of wire $= 0.645$
weight of ice $= 1.245 \times .05 \times 1.03 = 0.641$
Total vertical load $= 1.286$
Wind pressure $= \frac{8}{12} \times 1.53 = 1.020$
Resultant $= 1.641$
$T_1 = 35{,}000 \times 0.166 = 5{,}810$,
$M = 16{,}000{,}000$,
$E = 0.0000096$,
$Ma = 2{,}656{,}000$,
$MaE = 25.50$.

$$K = \frac{8Ma}{3S^2} = \frac{8}{3} \times \frac{2{,}656{,}000}{1{,}000{,}000} = 7.075 \quad (1)$$

$$d_1 = \frac{W_1S^2}{8T_1} = \frac{1.641 \times 1{,}000{,}000}{8 \times 5{,}810} = 35.3 \quad (2)$$

$$T_0 = T_1 - Kd^2 = 5{,}810 - 8{,}810 = 3{,}000 \quad (3)$$

| For $d =$ | 25 | 30 | 35 | 40 | (4) |
|---|---|---|---|---|---|
| $Kd^2 =$ | 4,420 | 6,350 | 8,650 | 11,300 | (5) |
| At 0 deg. F., $T_1 = T_0 + Kd^2$ | 1,420 | 3,350 | 5,650 | 8,300 | (6) |
| At 100 deg. F., $T_2 = T_1 - (t_2—t_1)\ MaE$ | — | 800 | 3,100 | 5,750 | (7) |

Deflections in line (4) are taken at any convenient values. Line (6) equals $T_0$ from line (3) plus $Kd^2$ from line (5). Line (7) equals line (6) plus constant $MaE$.

Curves for any other temperature desired are similarly computed. $Kd^2$ for line (3) and line (5) may be set down from a single slide-rule setting, thus:

| Scale A | $K$ | $Kd^2$ |
|---|---|---|
| Scale B | 1 | |
| Scale C | | $d$ |

*"Pull-up" Curves (constant loading):*
These are computed directly with slide rule from the equation

$$d = WS^2 \div 8T.$$

With a rule having an inverted-C scale all values for a curve may be read at one setting of the rule, thus:
Compute $F = S^2 \div 8$.

| Inverted C-scale | $W$ | $T$ |
|---|---|---|
| Scale D | $F$ | $d$ |

*Composite Wires:*
Wires composed of strands of two different metals may be treated as above using the following values:
$Ma = M_1a_1 + M_2a_2$,
$MaE = M_1a_1E_1 = M_2a_2E_2$.
One must be careful, however, that conditions of maximum load are properly taken. The maximum allowable stress may not be developed simultaneously.

If the two portions of the composite wire are clamped at $t°_2$ unstressed, the temperature then dropped to $t_1°$, and the wire stressed until one portion takes a load of $T_1$ lb., the other portion of the wire will take a load of:

$$T_2 = T_1 \left(\frac{M_2a_2}{M_1a_1}\right) - (t_2—t_1)\ M_2a_2(E_1—E_2) \text{ lb.},$$

or the total stress on the composite wire will be:

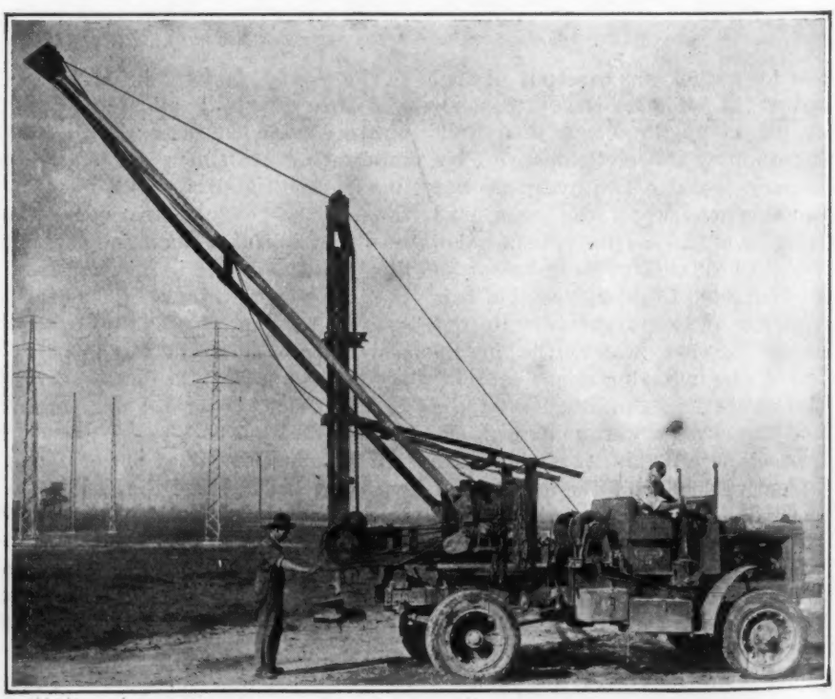
$$T = T_1\left(\frac{Ma}{M_1a_1}\right) - (t_2—t_1)M_2a_2(E_1—E_2) \text{ lb.}$$

## Pole Holes Dug for $1.47 with Boring Machine

THE economy obtained with the use of pole-hole boring machines by the Southern California Edison Company has well justified the use of the two machines now in use by that company. It has been found possible to dig sixty holes and set fifty poles in one working day, while the average day's work consists of setting forty poles per day. The average cost of digging holes with these machines is $1.47 each, which is only about 47 per cent of the cost of hand digging.

The above figure is based on the average use of the machine for three and one-half hours out of each working day—in other words, a load factor of 50 per cent based on six and one-half hours of possible machine operation every working day during the year. This cost includes interest and depreciation as well as operating charges.

These machines are mounted on a four-wheel drive truck and are especially designed for boring holes in earth and for raising and erecting poles. The hole is bored by means of an auger similar to a wood bit. The auger guides are adjust-



MACHINE FOR DIGGING POLE HOLES IS USED ALSO FOR EXCAVATING TOWER FOOTINGS AND BUILDING FOUNDATIONS

able as to angle, and the hole can be bored either vertically or at an angle for an anchor. The machines will dig both 18-in. and 24-in. holes to a depth of 8 ft. The crew consists of two men—a driver and an operator. The machines have also been found very useful in excavating for tower footings and for foundations for buildings.

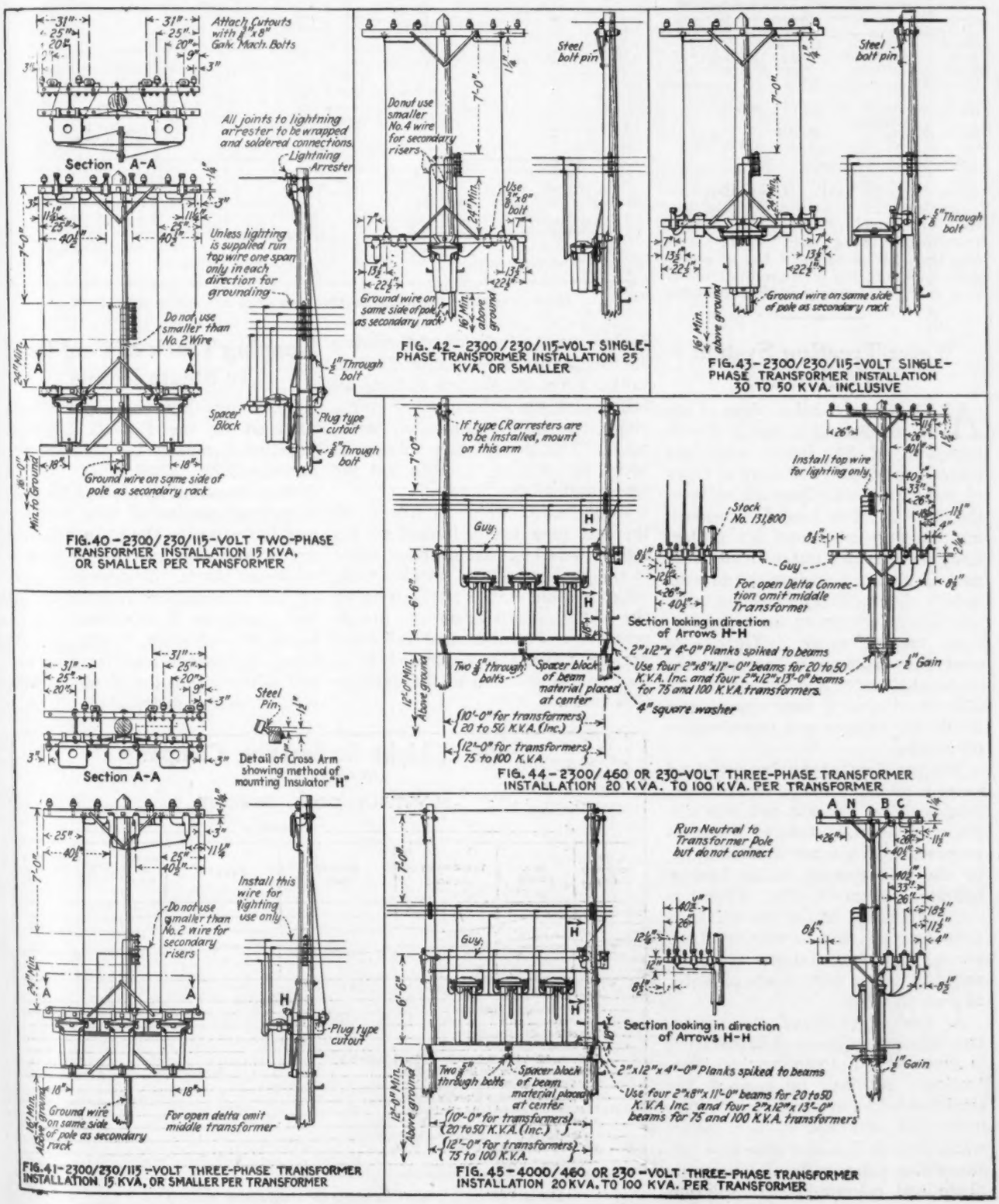
# Overhead Distribution Construction

Standardized Practice as Developed and Used by the
WEST PENN POWER COMPANY, PITTSBURGH

## Secondary Transformer Risers

*Secondary Risers.*—Secondary riser wires from transformer terminals to the secondary mains shall be arranged as shown in Figs. 40 to 51, inclusive, and shall have sizes as shown in Table XV. (Figs. 46 to 51 inclusive will be published in the April 26 issue of the ELECTRICAL WORLD.)

All secondary connections and taps shall be made as shown in Fig. 36A (see ELECTRICAL WORLD for March 29, 1923, page 630). Lugs shall not be


Attach Cutouts with ⅝"x8" Galv. Mach. Bolts
Section A-A
All joints to lightning arrester to be wrapped and soldered connections
Lightning Arrester
Unless lighting is supplied run top wire one span only in each direction for grounding
Do not use smaller than No. 2 Wire
½" Through bolt
Spacer Block
Plug type cutout
⅝" Through bolt
Ground wire on same side of pole as secondary rack
Min to Ground
FIG. 40 – 2300/230/115-VOLT TWO-PHASE TRANSFORMER INSTALLATION 15 KVA, OR SMALLER PER TRANSFORMER
Steel bolt pin
Do not use smaller No. 4 wire for secondary risers
Use ⅝"x8" bolt
Ground wire on same side of pole as secondary rack
16' Min. above ground
FIG. 42 – 2300/230/115-VOLT SINGLE-PHASE TRANSFORMER INSTALLATION 25 KVA, OR SMALLER
Steel bolt pin
⅝" Through bolt
Ground wire on same side of pole as secondary rack
16' Min. above ground
FIG. 43 – 2300/230/115-VOLT SINGLE-PHASE TRANSFORMER INSTALLATION 30 TO 50 KVA. INCLUSIVE
If type CR arresters are to be installed, mount on this arm
Guy
Stock No. 131,800
Install top wire for lighting only
For open Delta Connection omit middle Transformer
Section looking in direction of Arrows H-H
2"x12"x 4'-0" Planks spiked to beams
Use four 2"x8"x11'-0" beams for 20 to 50 K.V.A. Inc. and four 2"x12"x13'-0" beams for 75 and 100 K.V.A. transformers.
½" Gain
Two ⅝" through bolts
Spacer block of beam material placed at center
4" square washer
(10'-0" for transformers 20 to 50 K.V.A. (Inc.)
(12'-0" for transformers 75 to 100 K.V.A.
FIG. 44 – 2300/460 OR 230-VOLT THREE-PHASE TRANSFORMER INSTALLATION 20 KVA. TO 100 KVA. PER TRANSFORMER
Section A-A
Steel Pin
Detail of Cross Arm showing method of mounting Insulator "H"
Do not use smaller than No. 2 wire for secondary risers
Install this wire for lighting use only
Plug type cutout
Ground wire on same side of pole as secondary rack
For open delta omit middle transformer
FIG. 41 – 2300/230/115-VOLT THREE-PHASE TRANSFORMER INSTALLATION 15 KVA, OR SMALLER PER TRANSFORMER
Run Neutral to Transformer Pole but do not connect
A N B C
Guy
Section looking in direction of Arrows H-H
2"x12"x 4'-0" Planks spiked to beams
Use four 2"x8"x11'-0" beams for 20 to 50 K.V.A. Inc. and four 2"x12"x13'-0" beams for 75 and 100 K.V.A. transformers
½" Gain
Two ⅝" through bolts
Spacer block of beam material placed at center
(10'-0" for transformers 20 to 50 K.V.A. (Inc.)
(12'-0" for transformers 75 to 100 K.V.A.
FIG. 45 – 4000/460 OR 230-VOLT THREE-PHASE TRANSFORMER INSTALLATION 20 KVA. TO 100 KVA. PER TRANSFORMER

FIGS. 40 TO 45—SPECIFICATIONS FOR VARIOUS POLE-TYPE TRANSFORMER INSTALLATIONS

used on secondary transformer terminals.

Secondary racks shall in general be mounted above the transformers. There shall be a minimum clearance of 24 in. between the bottom of any secondary rack and the top of the transformer arm gain. The secondary rack shall ordinarily be placed as shown in Fig. 2 (see ELECTRICAL WORLD for January 19, 1924, page 144). If the above requirement for clearance between bottom of secondary rack and top of transformer arm gain would leave less than 24 in. between top of secondary rack and top of second-line cross-arm gain, a higher pole shall be used.

TABLE XV—SIZE OF SECONDARY RISERS FOR TRANSFORMER INSTALLATIONS

| Single-Phase | | Polyphase | |
|---|---|---|---|
| Size of Riser Wires | Capacity of Installation | Size of Riser Wires | Capacity of Installation |
| No. 4 | 25 kva. or smaller | No. 2 | 30 kva. or smaller |
| No. 2 | 30 kva. to 40 kva., incl. | No. 0 | 45 kva. |
| No. 0 | 50 kva. | No. 4/0 | 50 kva. to 150 kva. incl. |

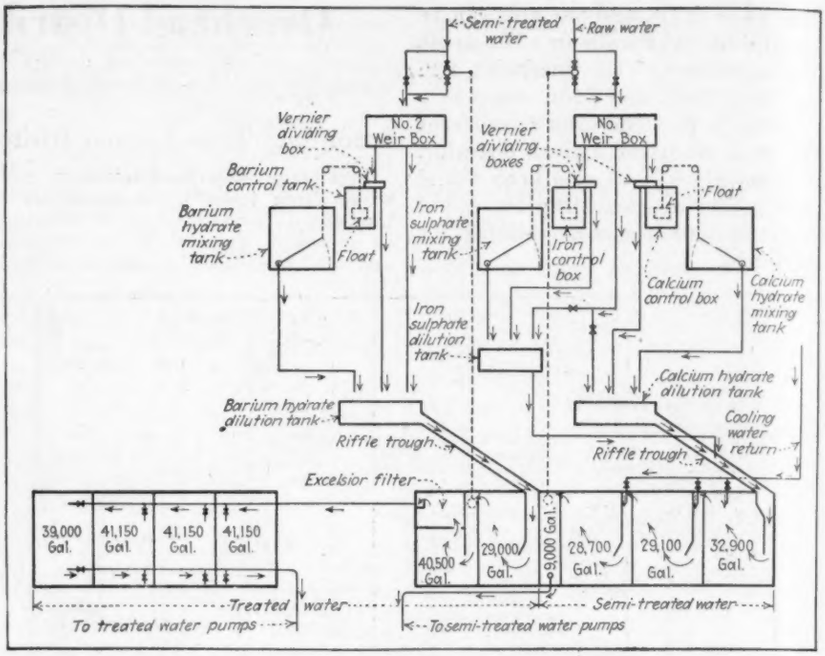
## Water-Treating System at Cahokia

AT THE new Cahokia plant of the Union Electric Light & Power Company of St. Louis conditions make it necessary that several types of water be used. Raw water from the Mississippi is used for condensing, sluicing ashes and fire protection; semi-treated water (mud taken out) is used for cooling compressor jackets, dry-vacuum pumps, fan bearings and oil coolers on the house turbine; treated water (softened) is used for make-up to evaporators; evaporated water and condensate for boiler feed, cooling generator air and finally for turbine and transformer-oil cooling.

The semi-treated or primary treated water is prepared by the cold process, using calcium hydrate and iron sulphate. The fully treated water is prepared from primary-treated water by the cold process, using barium hydrate. Semi-treated water is chlorinated and cooled for drinking purposes. As may be seen from the above, very few stations are compelled to use so many kinds of water as does Cahokia.

A flow diagram of the water-treating system in use at this station is given in the accompanying illustration. A float in one of the semi-treated water compartments regulates the admission of raw water, while vernier dividing boxes on the raw-water delivery to the iron-sulphate and calcium-hydrate dilution tanks control admission of these two chemicals to the respective dilution tanks. From the calcium-hydrate dilution tank the solution flows over a ripple to the semi-treated water tanks. The iron-sulphate solution is with the calcium hydrate on the lower half of the ripple.

Semi-treated water is drawn off the last pass and delivered to the second weir box that supplies water to the barium-hydrate dilution tank, which completes the purification of the water. Here again the proper proportion of semi-treated water and barium hydrate is controlled by a float in the last pass of the purification tanks.




FLOW DIAGRAM OF WATER-TREATING SYSTEM AT CAHOKIA STATION

## Keeping Track of Coal Used in Steam Plants

THE monthly coal-report form used by the Federal Light & Traction Company is shown in the accompanying illustration. This form is prepared by each of the subsidiary properties of this company and forwarded to the main office for use in following up the operation of all steam plants. Besides giving all of the information relative to the coal supply up to the time it is received at each plant, it also gives in detail the costs of handling both coal and ashes within the plant per kilowatt of energy distributed.

**Federal Light & Traction Company**

NEW YORK, N. Y.

**MONTHLY COAL REPORT**

of ..... Month of ..... 19....

| No. OF TONS RECEIVED DURING CURRENT MONTH | CAR No. AND INITIAL | TRADE NAME OF COAL | NAME OF MINE | SELLER | PRICE PER TON AT MINE | FREIGHT PER TON | TOTAL COST OF COAL PER TON F. O. B. PLANT |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | | | | | | | |

Tons on Hand at Beginning of Month
Tons Received During Month
Total Tons
Tons on Hand at the End of Month
Tons Burned During Month
Total Cost of Coal, F. O. B. Plant, Burned During Month
Total Cost of Unloading Coal During the Month
Total Cost of Firing During the Month
Total Cost of Ash Handling During the Month
Grand Total Coal and Ash Cost for the Month
Distributed K. W. H.
Lbs. Coal Burned During Month Per Distributed K. W. H.
Total Coal and Ash Cost Per Distributed K. W. H.

FORM FOR SUMMARIZING COST OF HANDLING COAL AND ASHES

# Daily Steam-Plant Log Used by Middle West Company

## SPRINGFIELD GAS AND ELECTRIC COMPANY
### SPRINGFIELD, MISSOURI

STEAM POWER STATION, DAILY LOG FOR 24 HOURS ENDING MIDNIGHT _____ (DAY OF WEEK), _____ (MONTH), _____ (DATE), 192

INSTRUCTIONS: Indicate period of operation of each piece of apparatus, or class of employee, by horizontal line, thus _____. Boiler banked, or apparatus running idle, by dotted line, thus _____. Boiler on natural instead of forced draft by dashed line, thus - - - - - - - - - - Explanation of any work done on apparatus, or interruptions to circuits, should appear in place of these lines, or in foot note on available blank space. Avg. means average of readings taken each hour.

**(A) APPARATUS IN OPERATION**

No. DESCRIPTION — 12 1 2 3 4 5 6 7 8 9 10 11 N 1 2 3 4 5 6 7 8 9 10 11 12 HRS.

BOILERS
1 890 H.P. STERLING
2 " " "
3 " " "
4
5
TOTAL BOILER HRS. | B.H.P. HRS. OPERATED | B.H.P. HRS. BANKED

(B) GENERATORS
1 5000 K.W. TURBINE
2 1800 " "
3 550 " D.C. ENGINE
4 600 " A.C. "
TOTAL GENERATOR CAPACITY OPERATED

(C) EXCITER SETS
1 30 K.W. MOTOR
2 50 " "
3 50 " TURBINE

(D) MOTOR GENERATORS
1 500 K.W. 500 V. 60 CY.
2 200 " 230 V. 60 CY.
3 200 " 230 V. 25 CY.

(E) PUMPS
1 BOILER FEED 350 G.P.M.
2 " " " "
3 " "
1 DEEP WELL
2 " "
1 HOUSE
2 "
1 TREATED WATER
2 " "
1 TANK

(F) MAIN CONDENSER AUXILIARIES
MOTOR DRIVE No. 1 CIRC.
TURBINE " " 1 "
MOTOR " " 1 COND.
TURBINE " " 1 "
" " No. 2 CIRC.

(G) STOKER BLAST FANS
1
2
3
4
5

(H) COOLING TOWER BLAST FANS
1-2-3-4-5
6-7-8-9-10
11-12-13-14-15
16-17-18-19-20

(I) COAL AND ASH HANDLING
COAL CONVEYOR
" CRUSHER
ASH CONVEYOR

(J) WATER SOFTENER
TANK No. 1
" " 2
" " 3

(K) MISCELLANEOUS APPARATUS
AIR COMPRESSOR
YARD CRANE ELEC. DEPT.
" " OTHER DEPT.
ENGINE ROOM CRANE

(L) OUTGOING FEEDERS
1 SOUTH WEST 60 CY.
2 FNBCO NORTH WEST "
3 PUB. SQ. WEST "
4 NORTH "
5 PUB. SQ. EAST "
6 PHELPS "
7 SOUTH EAST "
8 2200 V. 25 CYCLE
9 13000 V. "
10 250-500 V. D.C.
RAILWAY BUS

(M) STREET LIGHTING CIRCUITS
1 NORTH EAST
2 " WEST
3 MIDDLE EAST
4 " WEST
5 SOUTH EAST
6 " WEST

(N) IMPORTANT OZARK SUB-STATION EQUIPMENT
WHITE RIVER LINE
JOPLIN LINE
1 FREQ. CHANG. 1200 K.W.
2 " " "
3 " " 3000 "
500 K.W. ROTARY
CHARGING M.G. SET
STORAGE BATTERY

(O) CREWS (GIVE NAME AND TITLE OR DUTIES)

ENGINE ROOM LABOR HOURS | BOILER ROOM LABOR HOURS

**(P) PERFORMANCE OF BOILERS**

| | FLUE GAS TEMP. | | | PERCENTAGE OF $CO_2$ | | | RATE OF EVAP. B.H.P. | | |
|---|---|---|---|---|---|---|---|---|---|
| | MAX. | MIN. | AVG. | MAX. | MIN. | AVG. | MAX. | MIN. | AVG. |
| | | | | | | | | | |

**(Q) PERFORMANCE OF TURBINES**

UNIT No.
POUNDS STEAM CONSUMED
K.W.H. GENERATED
STEAM PER K.W.H. GENERATED

**(R) TEMPERATURE PRESSURE AND OTHER READINGS**

| TIME OF DAY | 3A | 7 | 11 | 3 | 7 | 11P | AVG. |
|---|---|---|---|---|---|---|---|
| TEMP. AIR ENGINE ROOM | | | | | | | |
| " " BOILER " | | | | | | | |
| " " " " BMNT. | | | | | | | |
| " FROM GEN. No. 1 | | | | | | | |
| " " " " " 2 | | | | | | | |
| " " " " " 3 | | | | | | | |
| " " DRY BULB OUTSIDE | | | | | | | |
| " " WET " " | | | | | | | |
| RELATIVE HUMIDITY | | | | | | | |
| TEMP. WATER FROM F.B. HEATERS | | | | | | | |
| " " " H.P. " | | | | | | | |
| " DISCH. CONDENSER No. 1 | | | | | | | |
| " " " " 2 | | | | | | | |
| " " " " 3 | | | | | | | |
| " CONDENSATE FROM No. 1 | | | | | | | |
| " " " " 2 | | | | | | | |
| " EXHAUST TURBINE No. 1 | | | | | | | |
| " " " " 2 | | | | | | | |
| " " " " 3 | | | | | | | |
| " BOILER FEED WATER | | | | | | | |
| " STEAM H.P. HEADER | | | | | | | |
| " " L.P. " | | | | | | | |
| " " HEATING MAIN | | | | | | | |
| PRESS. H.P. STEAM | | | | | | | |
| " L.P. " | | | | | | | |
| " HEATING MAIN | | | | | | | |
| VAC. CONDENSER No. 1 | | | | | | | |
| " " " 2 | | | | | | | |
| " " " 3 | | | | | | | |
| WEATHER (CLEAR, CLOUD, WIND) | | | | | | | |
| BAROMETER | | | | | | | |
| STAGE OF WATER AT POWER SITE GAUGE READING FEET | | | | | | | |

**(S) FUEL PURCHASE AND STORAGE DATA**

CARS UNLOADED

| INITIAL | NUMBER | SOURCE AND GRADE | LBS. COAL | GALS. OIL |
|---|---|---|---|---|
| | | | | |

CARS RECEIVED AND NOT UNLOADED

| | | | | |
|---|---|---|---|---|
| | | | | |

**(T) ANALYSIS COAL FIRED**

| B.T.U. | ASH | V. | F.C. |
|---|---|---|---|
| | | | |

**(U) ASHES**

YDS. ASHES SCAVENGED
" " LOADED OUT BY RAIL
" " " " " TRUCK AND WAGON
" " IN STORAGE
AVERAGE COMBUSTIBLE IN ASH PER CENT

**(V) WATER AND STEAM METER READINGS**

| | PRESENT | FORMER | GALLONS |
|---|---|---|---|
| CITY WATER METER No. 1 | | | |
| " " " " 2 | | | |
| PUMPED BY DEEP WELL | | | |
| TO GAS WORKS RAW | | | |
| " " " SOFT | | | |
| SOFT WATER MAKE UP LBS. | | | |
| BOILER FEED METER LBS. | | | |
| STEAM TO GAS DEPT. FOR GAS LBS. | | | |
| " " " " HEAT " | | | |
| STEAM TO HEATING DEPT. | | | |

**(W) WATER SOFTENING PLANT**

NO. TANKS WATER TREATED
" GALS. " "
LBS. LIME USED LBS. SODA ASH USED
ALKALINITY TREATED WATER
CAUSTICITY " "
AVG. HARDNESS TREATED WATER GRAINS PER GAL.

**(X) DAILY STATISTICS**

CONSUMED BY STEAM PLANT AUX. PER CENT TOTAL GENERATED
NET K.W.H. GENERATED (GEN. LESS ST. PLT. AUX.)
LBS. COAL ALLOCATED TO ELECTRIC GENERATION
" " " " STEAM HEATING
GALS. OIL " " ELECTRIC GENERATION
" " " " STEAM HEATING
LBS. COAL PER NET K.W.H. GENERATED
K.W.H. NET GENERATED PER GALLON OIL
LBS. WATER EVAPORATED PER LB. COAL
" " " " GAL. OIL
B.T.U. PER NET K.W.H. GENERATED
LBS. COAL PER SQ. FT. GRATE SURF. PER HOUR
AVG. BOILER EFFICIENCY PER CENT
LOAD FACTOR STEAM PLANT BASED ON K.W. HOURLY
" " SUB-STATION " " PURCH. "
" " ENTIRE STATION " " TOTAL "
TOTAL LABOR HOURS
K.W.H. GENERATED AND PURCHASED PER LABOR HOUR

**(Y) LOAD CURVES**

UNITS IN K.W.H. K.W. B.H.P.

K.W.H. Generated Hourly Dotted Line. Thus
" Purchased " Dashed " "
" Gen. & Purch. " Full " "
Boiler H.P. Capacity (Red Line) K.W. Generator Capacity (Green Line)

TIME — 1 2 3 4 5 6 7 8 9 10 11 N 1 2 3 4 5 6 7 8 9 10 11 12

10000
9000
8000
7000
6000
5000
4000
3000
2000
1000

TOTAL GEN. AND PURCHASED K.W.H.
TOTAL PURCHASED K.W.H.
TOTAL GENERATED K.W.H.
BUS VOLTAGE — 60 CY. / 25 CY.
POWER FACTOR — 60 CY. PURCH. % / GEN. %
HIGHEST INDICATING WATTMETER READING — PURCHASED K.W. / GENERATED K.W.

**(Z) DAILY WATT HOUR METER READINGS**

| CIRCUIT | PRESENT | FORMER | CONST. | K.W.H. |
|---|---|---|---|---|
| GENERATOR No. 1 5000 K.W. | | | | |
| " " 2 1800 " | | | | |
| " " 3 550 " | | | | |
| " " 4 600 " | | | | |
| STEAM EXCITER | | | | |
| TOTAL GENERATED | | | | |
| No. 1 FEEDER S.W. | | | | |
| " 2 " N.W. | | | | |
| " 3 " P.S.W. | | | | |
| " 4 " N. | | | | |
| " 5 " P.S.E. | | | | |
| " 6 " PHELPS | | | | |
| " 7 " S.E. | | | | |
| " 8 " 25 CY. 2200 V. | | | | |
| " 9 " 25 CY. 13000 V. | | | | |
| STREET LIGHTING | | | | |
| 250 V.D.C. 60 CY. METER A | | | | |
| " " " " B | | | | |
| " " 25 CY. " A | | | | |
| " " " " B | | | | |
| RAILWAY 500 K.W. M.G. | | | | |
| " 200 " " | | | | |
| " ROTARY | | | | |
| " STEAM GENERATOR | | | | |
| TOTAL ENERGY SENT OUT OVER FEEDERS | | | | |
| INPUT STEAM PLANT AUX. | | | | |
| " " " EXCITERS | | | | |
| TOTAL 25 CY. FROM OZARK | | | | |
| INPUT OZARK AUXILIARIES | | | | |
| AMOUNT PURCHASED POWER FROM HYDRO | | | | |
| " " " " JOPLIN | | | | |
| TOTAL 25 CYCLE FROM OZARK LESS / SUB-STATION AUXILIARIES | | | | |
| TO SUB-STATION FROM SPRINGFIELD STEAM PLANT 60 CYCLE | | | | |
| FROM " " TO OZARK CO. BY " " 25 " | | | | |
| SUB-STATION AUX. INPUT (/) PLUS FREQUENCY CHANGER AND ROTARY LOSSES | | | | |
| ABOVE IN PER CENT OF TOTAL PURCHASED | | | | |

REMARKS AND MISCELLANEOUS

Signed _____ Chief Operating Engineer

The very complete steam-power station daily log sheet used by the Springfield (Mo.) Gas & Electric Company is shown herewith. This form is prepared in quadruplicate in order that copies may be referred to all members of the organization who may be interested. The performance of all important equipment in the station is recorded on this sheet in a very concise manner.

# Central Station Business

**Advertising, Selling and Service Methods**
**Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences**

## Electric Trucks Invading the "Automobile City"

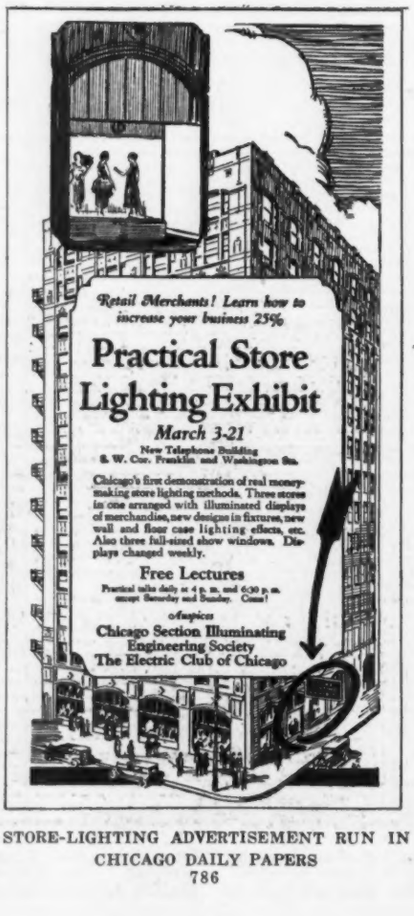
TWENTY 1-ton Commercial electric trucks, soon to be placed in service by the Wagner Baking Company in Detroit, mark the second important invasion of that famous automobile city by the electric vehicle for delivery work. The decision on the part of the baking company to purchase this fleet of "electrics" instead of gasoline cars may be regarded as a distinct victory for the electric truck over both gasoline-driven and horse-drawn equipment for short-haul city delivery. This is especially true in view of the fact that the bakery, located right in the city of Detroit, the home of many light gasoline trucks, could have purchased its equipment direct from a gasoline-truck manufacturer and there would have been no freight charges. The twenty electric trucks must be shipped from Philadelphia to Detroit.

Some of the considerations which finally led to a choice of the electric vehicle over all others are interesting. The baking company in this instance has a large equipment of horse-drawn vehicles and its business had been growing so rapidly as to make an expansion of its delivery system imperative. Stables were situated near the baking plant, but additional land would have had to be purchased and its cost was prohibitive. Gasoline trucks were first considered; then two "electrics" were placed in trial service and proved to do the work satisfactorily. It had been decided to abandon the horse-drawn wagons in favor of electric or gasoline trucks and utilize the stable for a garage. At this point it was found that if gasoline cars were purchased the insurance rate on the building would be about double the rate which could be obtained if "electrics" were used and charging equipment installed. Under those conditions space formerly occupied by the stable would be available and could be used to expand manufacturing operations. All of these conditions pointed to such a decided economic advantage for the electric truck that it was not necessary to enter into a discussion of comparative operating costs.

Another interesting use of the electric truck in Detroit is a fleet of eighty-eight Ward vehicles operated by the Mills Baking Company. These are in service under conditions closely approximating house-to-house delivery, which is supposed to be the ideal field for the horse. However, the Mills company has found the electric to be more satisfactory both in operating and investment costs as well as in materially speeding up deliveries.

## Staging a Store-Lighting Demonstration

A DEMONSTRATION of intensive store lighting for the purpose of showing local merchants what can be accomplished with good lighting was recently completed in Chicago. This demonstration was effective in drawing about fifty merchants per day to a series of lectures. It was conducted under the joint auspices of the Chicago Section of the Illuminating Engineering Society, the Electric Club of Chicago, the Commonwealth Edison Company, the Public Service Company of Northern Illinois, fixture manufacturers, contractors and electrical jobbers. Since this was the first practical store-lighting demonstration ever held in the city, particular care was taken to make it successful. Nine committees were appointed by the Chicago Section, I. E. S., to handle the complete organization work—advisory, general, finance, publicity, illumination and display, wiring, exhibit, attendance and "tie-in." A. A. Gray was chairman of the general committee.


Retail Merchants! Learn how to increase your business 25%
Practical Store Lighting Exhibit
March 3-21
New Telephone Building
S. W. Cor. Franklin and Washington Sts.
Chicago's first demonstration of real money-making store lighting methods. Three stores in one arranged with illuminated displays of merchandise, new designs in fixtures, new wall and floor case lighting effects, etc. Also three full-sized show windows. Displays changed weekly.
Free Lectures
Practical talks daily at 4 p. m. and 6:30 p. m. except Saturday and Sunday. Come!
Auspices
Chicago Section Illuminating Engineering Society
The Electric Club of Chicago

STORE-LIGHTING ADVERTISEMENT RUN IN CHICAGO DAILY PAPERS

Direct "tie-in" with the purpose of the exhibits and the local electrical men was obtained by three preliminary lectures on good lighting held the last week in February, which were given before contractor-dealers so that they would be able to answer questions asked by merchants after visiting the store-lighting demonstration. More than seven hundred cards announcing these lectures at the Electric Club were sent out to the electrical manufacturers, jobbers and contractor-dealers.

Instead of scattering effort, a district one mile from the center of the "Loop" was chosen. J. J. Kirk was made attendance chairman. From the meter records of the Commonwealth Edison Company 7,500 retail merchants were picked and letters were sent by this company announcing the demonstration. These 7,500 merchants were divided into districts having 500 names apiece. To avoid overcrowding the demonstration rooms, only 500 letters were placed in each evening's mail. Then

Address Phone

Firm

Business

Individual

Lecture Preferred—Mon., Tues., Wed., Thurs., Fri. 4 p. m. 6:30 p. m.

Attitude When You Called

1. Not clearly understood
2. Thought it a selling scheme
3. Received mail announcement
4. Did not receive announcement
5.
6.

Attitude After You Explained

1. Realizes importance of lighting
2. Will attend in person
3. Will send representative
4. Interested but no promise
5. Says—too busy
6. Alone in store—cannot get away
7. Lecture hours inconvenient
8. Entirely disinterested
9.
10.

Remarks

Date Committee Member

Phone Follow-up

1. Appreciated phone call
2. Had forgotten
3. Will attend
3. Will send representative
4. Has attended
5. Cannot attend

Remarks

Date Operator

CARD USED TO MAKE SURE THAT MERCHANTS VISITED THE DEMONSTRATION

fifteen staff men, who were furnished by the contributors to the lighting demonstration, made personal calls the next day to determine the views of the dealers, which were recorded on cards, as shown above. This was later followed up by a telephone call to each merchant reminding him of his promise to attend.

The lighting equipment used for the demonstration was chosen to show standard practices of modern lighting without favoring any one manufacturer. Besides using three front display windows with different equipment, the exhibit also included two rooms which contained equipment from other companies. In one a typical well-lighted store was arranged to impress the merchants with the results obtainable with sufficient illumination. The interior lighting was divided into four classes —indirect, semi-indirect, totally inclosed with enameled lamps, and with opal glass. To be fair to all the manufacturers five periods of three days were allotted to each

Another room was used as a lecture hall, and a thirty-minute talk was given explaining how results like those shown in the first room visited could be attained. A stage was used to illustrate all the different lighting effects.

The financing of the demonstration was handled through voluntary subscriptions totaling over $6,000 which was contributed by sixty-two representatives of the electrical industry in Chicago, including central stations, manufacturers, jobbers and contractor-dealers, besides members of the Electric Club of Chicago.

## Visualizing a Company's Progress

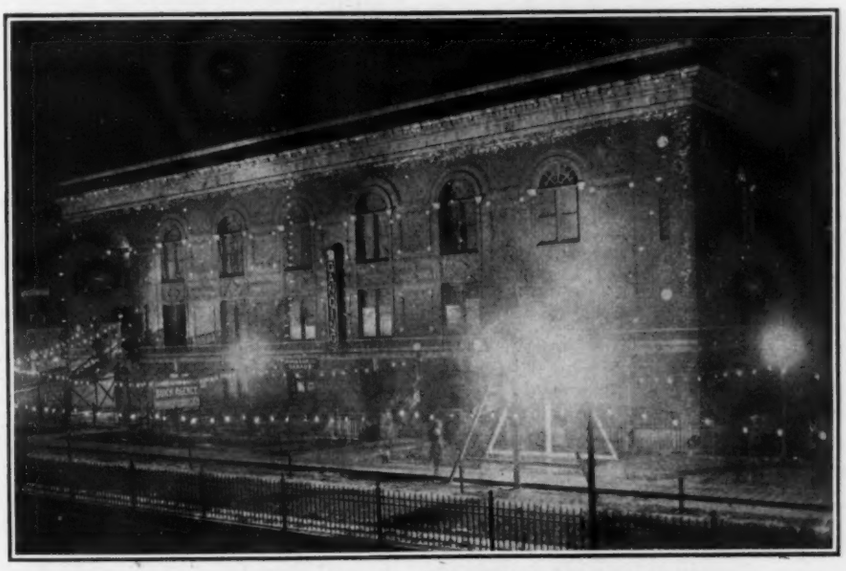
A GRAPHIC record of some of the company's achievements is kept on the wall in the office of the assistant general manager of the Consumers' Power Company, Jackson, Mich., to enable the management to compare current performance—commercial, financial, operating, and otherwise—with what has been attained in previous years. This graphic record consists of eight curves indicating the monthly variations from the beginning of the company up to date in total gross earnings, meters installed, total sales in kilowatt-hours, distribution expenses and expense per meter connected, primary sales in kilowatt-hours, other primary sales, total operating expenses, and production and transmission expenses per kilowatt-hour sold. Because of the promptness of the comparisons which can be made in each of these various items with the same items for other periods, this graphic record is very helpful to the company in checking up its current operations.

## Bangor's Electric Show a Notable Success

AN EXAMPLE of how the central-station company, electrical dealers, manufacturers and jobbers can co-operate to stage a successful electrical show in a small city is seen in the recent three-day electrical exposition at Bangor, Me., under the auspices of the local electrical interests. More than ten thousand visitors were recorded during the three days the show was open to the public.

This was the first show of the kind ever held in the city, and all branches of the industry contributed to its drawing power. It was held in The Chateau, in the heart of the retail district, with free admission. Representatives of leading electrical manufacturers made addresses and demonstrations, the Bangor Railway & Electric Company broadcasted instructive and entertaining programs from the company's radio station "WABI," and local dealers maintained attractive exhibits. A prize-essay contest for public school teachers and pupils was conducted to bring out the advantages of electric service in the home.

Talks on electric cookery were



EXTERIOR LIGHTING OF BANGOR ELECTRICAL EXPOSITION BUILDING ATTRACTED STATE-WIDE INTEREST

given by Miss Jane Fillmore of the Westinghouse Electric & Manufacturing Company and Miss Grace Hallowell of the Edison Electric Appliance Company, Inc., and addresses on domestic and industrial illumination were given by Julius Daniels of the Boston Edison Company. Twenty-four cash sales were made, amounting to $959.80, and the eleven exhibitors obtained 277 prospective customers.

W. G. Burrill of the Bangor Railway & Electric Company was the chairman of the exhibition committee.

## Getting the Utilities' Story Across to the Public

A VALUABLE service to the public utility industry is being performed by P. L. Thomson, president of the Association of National Advertisers and publicity manager of the Western Electric Company, in an address, "You and Your Public Utilities," which he is giving before advertising clubs and over some broadcasting stations throughout the country. The address is presented as a straightforward analysis of just what the successful operation of the utilities means to the development of a community and the consequent interest that the individual citizen has in seeing that they get fair treatment.

The most gratifying thing about the presentation of this talk, according to Mr. Thomson, has been the wide interest manifested by those who have heard it, particularly over the radio, evidencing a very real interest on the part of people generally. Several hundred requests have been received from radio listeners from the stations over which the address was broadcasted, asking for copies of the speech. In many instances these requests told of local situations where the issues of private versus public ownership were pending. From among the letters received the following are typical comments:

*From a Western state university:*

"Rush copy Thomson's speech public utilities for debate next week."

*From a Kansas farmer:*

"Please send me a copy of that speech on public utilities broadcast on your 6 o'clock program last evening. You are certainly doing a great thing for us farmers."

*From an Arkansas farmer:*

"We continue to enjoy your programs from time to time. We have just been listening to Mr. Thomson on our utilities. I only wish every one in Arkansas could have heard it."

*From the manager of a Missouri manufacturing business:*

"The writer will appreciate receiving a copy of Mr. Thomson's address on utilities. The facts contained in his talk are of great interest to me, and possibly an opportunity may present itself to use them forcibly."

*From the manager of a telephone company in Illinois:*

"Can we get a few extra copies of Mr. Thomson's address? Would be glad to pay for them as we think they would be fine to distribute to our customers."

One letter of particular interest and significance was received from a town in Illinois where there is keen agitation for a municipal electric plant. This letter, which is published in full here, may be taken as an indication that there is a very considerable amount of straight thinking being done by at least a part of the public on the question of government and municipal ownership. The letter reads:

GENTLEMEN—Last night I chanced to tune in on a talk given by some one at your station WMAQ on public service corporations, and I enjoyed what I heard very much. It happens that we are having something of a fight here over municipal versus privately owned electric, gas and street-railway utilities. In this connection would you kindly bring this letter to the attention of last night's speaker, together with the following questions: Are municipal lighting plants proving successful? About how many are in existence? How many have returned to public service corporations for service?

We are out to defeat a so-called municipal electric plant. If it were a real "honest-to-God" municipal plant we should be for it, but it seems to be a political rather than a municipal outfit. We wish this information for publication and anything offered will be appreciated. Very truly yours,

——, ——.

The following excerpts from Mr. Thomson's address, which is of vital interest to all public utilities, indicate the manner in which he is presenting this subject. The results obtained are a practical demonstration that the story of the public utilities can be brought home to the public in such a way that the people will come back and ask to be told still more about it:

Have you ever realized that whether you live in the city, the village or on the farm there is a community of interest between you and these utilities? Without them the civilization of which you are a part simply could not exist. Without them your community could not possioly grow. As a representative of a typical industry with branches all over the United States I can say to you that manufacturers fear to locate factories where such services are not ample. When they find a city where for political or other considerations the utilities are not being allowed franchises and rates sufficient to enable them to earn a fair return they turn away, because they are looking for locations where there is community harmony, where the people have learned that their interest is a mutual one with their utilities.

When we find the people in any community investing their savings in these utilities which serve them as customers with light, communication or transportation, then we have true public ownership. Then, as a stockholder in your local light company, for instance, you want only a fair return for the money you have invested, and as a customer you ask only adequate service at fair rates. In other words, your interest as owner and customer is identical. Fortunately many investments of this character are now open throughout the country. It will pay you to consider them with your local banker and thus place your money where the return upon it will be sure though conservative and where at the same time you may be contributing to your own comfort and the prosperity of your city.

## What Other Companies Are Doing

**Chicago, Ill.**—During 1923 more than nine hundred members of the Commonwealth Edison Company earned $350,000 in addition to salaries by selling securities during their spare time. This means that 10 per cent of the personnel, besides receiving $35 a month over their regular pay, were afforded an opportunity to develop any talent they might have for the financial side of the company's business and also an opportunity to bring themselves to the personal attention of the heads of the various departments. This bringing out of the sales ability of all employees is part of the management's plan to prepare employees to become executives.

**Seattle, Wash.**—An extensive electric range campaign covering a period of forty days was started by the Puget Sound Power & Light Company on April 1. The campaign will be staged in conjunction with the Edison Electric Appliance Company. A special sales force will be put on and advertising will be carried in local newspapers. Demonstrators and speakers furnished by the manufacturer will be placed in all district offices. Last year 1,400 ranges were added to the company's lines, and it is hoped that 2,500 will be sold this year.

# Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

*Photostat copies or English translations of complete articles will be furnished at cost upon request*

## Hydro-Electric Development and Steam Equipment

*Turbine Pump for Boiler Feeding.*—C. H. S. TUPHOLME.—Recent installations in Great Britain indicate the growing use of the turbine pump for supplying feed water to boilers. Turbine pumps are well suited for boiler-feeding purposes where a total quantity of 50 gal. per minute and upward is essential. The pump can be driven direct by an electric motor of either the continuous or alternating-current type or by a direct-coupled steam turbine. Some of the pumps now being used for this purpose are described and discussed.—*Power Plant Engineering*, March 1, 1924.

*Hydro-Electric System in Tasmania.*—An argument for the Great Lakes power scheme is the fact that a large catchment area in a rainy portion of Tasmania exists in the center of the island, at an elevation of 3,350 ft. above sea level, where water can be conserved. The power development has been worked out as follows: A dam has been built at the southern end of the Great Lake, thereby cutting off the flow of the lake into the River Shannon. The storage has been increased by diverting into the lake the head waters of the Ouse, a few miles to the west, by means of a diversion weir and a canal. A few miles downstream along the River Shannon another diversion weir has been built, and a canal takes the water so diverted to a point at which it is possible to turn it into pipes and drop it nearly 1,200 ft. to turbines situated on the banks of the River Ouse. General data on the development, transmission lines and substations are given in tabular form. A total of 67,470 kva. is being developed. — *Electrical Times* (*England*), Feb. 21, 1924.

## Generation, Control, Switching and Protection

*Disconnecting Switches for High Currents.* — W. NAGEL. — Past experiences with disconnecting switches have given a number of helpful hints for the design of modern types for use in large generating plants where currents of several thousand amperes combined with voltages up to 35 kv. have to be handled with safety. Laminated copper brushes have been found unsuitable for these switches as they are very liable to oxidize and consequently overheat. A limited number of solid copper bars engaging into solid stationary copper jaws, with each bar under the influence of its individual set of helical steel springs and all contact surfaces carefully ground together, gave the best results. Clean copper surfaces are better than nickel-plated or tinned contacts. Slight oiling will increase the contact resistance about 30 per cent but is an effective means to retard oxidization. The tendency of disconnecting switches to open under a heavy short circuit can be overcome by avoiding an asymmetric field formation. For this reason the new switches have their terminal plates half the height of the knives. The gradual development and improvement of these switches is clearly demonstrated in several illustrations.—*Siemens Zeitschrift*, February, 1924.

*Economical Calculation of Distribution Networks.*—MICHELE PIZZUTTI.—The author, after recalling a few theorems connected with the subject, shows how it is possible to solve a distribution problem in a very satisfactory general way by introducing some simplifying hypothesis. Distribution networks for agricultural purposes, which require a still more elaborate study, are specially treated. The author concludes by giving and demonstrating the general formulas. These should be of great help also for preliminary proposals on the subject, because they lead to a determination of the number of substations required and the necessary distance from substations to the generating station. — *Elettrotecnica*, Feb. 5, 1924.

## Transmission, Substations and Distribution

*High-Tension-Cable Construction.*—ELVIO SOLERI.—The author deals with the latest developments on high-tension-cable construction. Dielectric rigidity, dielectric losses and power factor are specially considered and different methods of measuring the dielectric losses are described and illustrated. He concludes by dealing with the different materials necessary to manufacture a cable and explains how those materials are to be selected. A diagram shows the variation of the insulating resistance between conductors during the manufacture of a cable, illustrating the importance of putting the constructing cable under test from time to time.—*Elettrotecnica*, Jan. 25, 1924.

*High-Voltage Pin-Type Insulator.*—W. WEIKER.—A new insulator of the pin type has been developed by one of the leading German porcelain factories for voltages between 6,000 and 80,000. The insulator model is made up of one, two or three parts cemented together, the number depending on the voltage, of which the top part is unusually large in diameter and resembles a shallow umbrella. The configuration of the rain petticoats is such as to be as closely as possible at 90 deg. to the field lines between line wire and pin or within equipotential surfaces. It is claimed that internal corona discharges have been virtually eliminated, so that flashover occurs suddenly across the edges of the petticoats. The capacious inner corners are readily accessible for cleaning, an advantage which is of value in smoky atmospheres or near the seacoast. The circular-wire groove on the top petticoat is, contrary to previous practice, above the end of the pin, which submits the porcelain to a bending stress. Mechanical tests have shown, however, that in case of excessive horizontal pull the steel pin bends but the porcelain does not break.—*Elektrotechnische Zeitschrift*, Feb. 28, 1924.

## Units, Measurements and Instruments

*Influence of Support Upon Surface-Resistance Measurements.* — R. DIETERLE.—When determining the ohmic creepage resistance on the surface of insulating plates, the nature of the support upon which the plate rests during the test is in certain cases of considerable importance. If the insulating material has a very large resistance, the support has practically no influence, even for very thin plates. For a material of lower dielectric strength, however, a measurement made on the plate resting on a grounded support will give much too high a value and will therefore be misleading. This fact is due to a large number of electric field lines going through the plate to ground without passing the measuring instrument. According to the nature of the dielectric measured, the difference may be as high as one in twenty. —*Elektrotechnische Zeitschrift*, Feb. 21, 1924.

*Measurement of Air Flow.*—R. O. KING.—The development of the platinum resistance thermometer to be the most accurate means for the measurement of temperature has been followed by many attempts to use similar methods for the measurement of air or gas flow. The object of this paper is to describe Professor Callendar's method of using a heated wire to measure the rate of air flow and the preliminary development of this method at the Air Ministry laboratory in England. The method is applicable to the measurement of the flow of any gas, including steam. In using this method an electrically heated wire is cooled by the flow of air the velocity of which it is desired to measure, and the rate of loss of heat by the wire measured in electrical units gives a measurement of the rate of air flow. Measurements of a very high order of accuracy can be obtained.—*Engineering* (*England*), Feb. 1 and 22, 1924.

*Measurement of Electrical Energy in Alternating-Current Circuits.*—G. W. SUBBINGS.—The author reviews the present-day methods of metering energy in high-power alternating-current circuits, paying particular attention to the difficulties caused by the use of instrument transformers. Discussing meters with current transformers, he says that when currents exceeding 50 amp. have to be dealt with in low tension circuits, and for all currents in high-potential circuits, it becomes necessary to utilize a current transformer. The employment of a current transformer in conjunction with an induction meter, however, causes errors, which are usually of a more serious nature than those contained in the instrument itself. For the purpose of obtaining accurate measurements in

three-phase circuits at least two meters are necessary. It is a common practice in this case to use meters containing two elements which supply torque to the same rotor, the total energy being registered on a single dial.—*World Power (formerly Beama)*, March, 1924.

## Illumination

*Determination of Daylight Intensity at a Window Opening.*—H. H. KIMBALL.—A method of determining the extent of the shading of window openings by neighboring buildings, first given in the report for 1921, is reviewed and extended. The advantage of laying out cities so that the streets run from northeast to southwest and from northwest to southeast instead of from east to west and from north to south is pointed out. Determinations of the reflecting power of surfaces of different kinds and photometric measurements of their brightness under both cloudy and clear-sky conditions are also summarized. The data thus brought together—namely, the brightness of the sky, the intensity of daylight, the shading effect of nearby buildings and other objects, and the reflecting power, or the brightness of different surfaces—is utilized to compute the intensity of daylight at a window opening under given conditions. — *Transactions of I. E. S.*, March, 1924.

*Flicker Photometer for Heterochromatic Photometry.* — J. GUILD. — A flicker photometer is described which is specially designed to fulfill the conditions requisite to accuracy and precision in the use of such instruments. The photometric field subtends 2 deg. at the eye and is surrounded by a steady white field which subtends 25 deg. Special attention has been given to minimizing the loss of light, so that the high field brightness employed in flicker photometry can be obtained without bringing the illuminants unduly near the photometer head.—*Journal of Scientific Instruments (England)*, March, 1924.

## Motors and Control

*Analytical Determination of the Voltage-Steps in the Starter of a Single-Phase Series Motor.* — S. P. SMITH and M. G. SAY.—A convenient method of calculating the voltages required for the starting of a single-phase series motor can be derived when the power-factor-current and speed-current curves are known for some particular voltage. The method is rendered possible by the fact that the component of the terminal voltage absorbed in the reactance is a function of the current only, being independent of the magnitude of the motor terminal voltage. In this highly mathematical paper the authors treat the subject of determining the voltage steps of a starter very thoroughly.—*Selected Engineering Paper No. 11 of the Institution of Civil Engineers (England).*

*Theory of Direct-Current Armature Winding.*—H. J. S. HEATHER.—The author treats the subject in a clear, simple and logical mathematical manner, involving no complexities and using only algebraical and trigonometrical formulas. Formulas are worked out from first principles applicable to both lap and wave windings. The author concludes with some interesting deductions from a mathematical basis concerning the number of brushes necessary.—*World Power (formerly Beama)*, March, 1924.

*Polyphase Induction Motors.*—G. WINDRED.—A discussion of the various methods of starting and speed control of polyphase induction motors. The author considers the delta-star method of starting, the auto-transformer method and the insertion of resistances in series with the stator winding. This latter method is inefficient and should be confined to the class of very small motors.—*Electrician (England)*, Feb. 15, 1924.

## Telegraphy, Telephony, Radio and Signals

*Mercury-Arc Lamp as a Spark Gap and Interrupter.*—W. BURSTYN.—With the aid of a Hewitt "starting band," which is a small condenser formed between the mercury, the glass wall and a narrow metal band around the lamp tube, a mercury lamp may be artificially ignited so as to start with a voltage below the critical potential. A lamp so started may be used as a controlled-impulse spark gap for rigid coupling, using direct current of a few hundred volts as operating voltage. If a charged condenser is placed across a burning mercury lamp, the lamp will go out. A combination of such artificial starting and stopping permits a mercury-vapor lamp to be used as an interrupter for spark coils, giving up to 1,000 interruptions per second. A number of possible connections are given to achieve this purpose. To maintain charging and discharging of the condenser at regular intervals a small motor-operated contact is required, which, however, has to make and break only the ignition current of a few hundredths of an ampere.—*Jahrbuch der Drahtlosen Telegraphie und Telephonie*, January, 1924.

*Development of Pupin Coils.* — F. HORNING.—The first type of Pupin coils, with silicon steel sheets of 0.03 mm. thickness, were soon found to be inadequate on account of their small magnetic stability and their great variation of resistance with changing frequency. The wire-wound core type was introduced as an improvement and gave perfect satisfaction. Since the era of repeater tubes, multiple telegraphy and the increasing number of alternating-current electrifications, the magnetic and electric properties of Pupin coils have, however, been put to such severe tests that their performance is no longer satisfactory. Further research work has developed the pressed-iron-powder core of perfectly circular cross-section, with which a faultless transmission of speech can be achieved under any circumstances. The iron powder used must be fine enough to pass through a wire mesh of 63,000 meshes per square inch.—*Elektrotechnische Zeitschrift*, March 6, 1924.

*Radio-Telephone Signaling.*—C. S. DEMAREST, M. L. ALMQUIST and L. M. CLEMENT.—A signaling system is described which supplies in the field of radio telephony the same sort of calling facilities that are now available in wire telephony. By its means the radio attendants or subscribers are enabled to signal each other without requiring the called party to listen with a receiver. Some possible fields of usefulness of the system, its outstanding characteristics and the apparatus which it employs are described. — *Journal of the A. I. E. E.*, March, 1924.

*Screening of Radio Receiving Apparatus.*—R. H. BARFIELD.—The chief object of the investigation was to obtain quantitative information on the effect of screens of which the dimensions are small compared with the wave length of the waves they are intended to screen. A discussion of the experiments with some explanation of the various effects is given, and conclusions are drawn as to the general principles of screening and as to the essential points to be studied in the design of efficient screens for various purposes. —*Journal of the Institution of Electrical Engineers (England)*, March, 1924.

## Electrophysics, Electrochemistry and Batteries

*Advances Made in X-Ray Apparatus.* —G. HEBER.—Considerable advances in the last ten years may be recorded in the design of the X-ray tube. Cold cathode tubes with effective water cooling are now available for Roentgen therapy, designed to carry as much as 2.5 milliamp. at 200 kv. for several hours. A hot cathode tube is shown with two heating filaments suitable for 20 milliamp. and 100 milliamp. respectively, the former for treatment, the latter for short exposures. Great changes have taken place in the design of mechanical interrupters for high-power spark coils. At present the motor-driven mercury-jet interrupter, operating in an atmosphere of illuminating gas, seems to be the best available. The most reliable service is given by X-ray sets, using an oil-filled single-phase transformer in conjunction with a synchronous motor-driven mechanical rectifier of the Delon type. If only direct current is available, the driving motor is wound as a small rotary converter. With proper shape of the tube and perfect cooling of the anode, the X-ray tube may also be fed directly with alternating current, and it operates then as a rectifier and Roentgen ray generator. — *Elektrotechnik und Maschinenbau*, March 16, 1924.

## Miscellaneous

*Traveling Crane for Piers.*—W. A. PERRY.—An installation of an electric crane has recently been made at the Firth of Clyde, Scotland, for the Ardrossan Harbor Company. These cranes are capable of dealing with loads up to 7 tons, at a maximum radius of 45 ft., and each has four separate motions, that is, hoisting, luffing, slewing and traveling. — *Electrical Review (England)*, Feb. 5, 1924.

*Standardization.*—The American Engineering Standards Committee has just issued a twenty-four-page pamphlet describing how standardization is being carried on in the individual plant, in the industry as a whole, nationally on an interindustrial basis and internationally.—*Pamphlet of the American Engineering Standards Committee.*

# Scientific and Industrial Research

**A Department Devoted to Reports of Investigations Contemplated or Completed, Research Facilities Available and Suggestions for Co-operative Work**

*Conducted by* PROF. VLADIMIR KARAPETOFF, *Cornell University, Ithaca, N.Y.*

[ PRINTED IN THE THIRD ISSUE OF EACH MONTH ]

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

## Research Completed

### Ammeter Shunt, Use of Copper Conductor for

Large copper conductors in some direct-current circuits of the Commonwealth Edison Company have been successfully used as ammeter shunts by the addition of so-called compensating coils in the ammeter circuits proper. These coils consist of fine copper wire and are mounted directly over the heavy copper conductors. The temperature—and the resistance—of the copper shunts varies in the same proportion as that of the compensating coils, thus automatically causing the same fraction of the total current to flow through the ammeters. The advantages are (a) a saving in the cost of usual ammeter shunts, (b) a reduction in the number of contacts and joints in circuits carrying heavy currents.—*Minerallac Electric Company, Chicago.*

### Clock, Electric, with Detached Pendulum and Continuous Motion

A mechanism has been developed for connecting a pendulum and motor without the use of the ordinary escapement. Impulses are given to the pendulum by a "gravity arm," which at the end of the impulse is arrested by a fixed stop with which the arm makes electrical contact, thereby short-circuiting a resistor in series with the motor and allowing an "impulse" to be given to the motor. Should the speed of the motor decrease slightly, the duration of the electrical contact is longer and the speed is brought up to normal. For details see *Proceedings Royal Society of Edinburgh (Alex. Stewart)*, Vol. 43, p. 154, 1923.

### Distributing Network, Alternating-Current Protective Device for

The design of a protective device which makes possible the use of solid secondary distribution systems for alternating-current service has been perfected, and the device is being manufactured. It automatically trips off the source of power of the network in case of failure in the high-tension apparatus or line and reconnects to the network only when proper voltage and phase relationships obtain. Thus there is opened up the practicability of service continuity with alternating-current distribution comparable with that obtained on solid direct-current networks. This development frees alternating-current distribution from its worst limitations and allows it to capitalize on its inherent advantages.—*Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.*

### Galvanometer, Ballistic, Varying the Sensitiveness of

The throws of a ballistic galvanometer on closed circuit with and without added resistance do not vary inversely as the total resistances because of the change in damping. General formulas for the change in throws caused by added resistance have been derived for moderately damped, critically damped and overdamped galvanometers and summarized in a table. With the aid of this table the throws may be changed at will in any desired proportion. A special discharge key has been designed by means of which throws may be obtained that are inversely proportional to the circuit resistances.—*M. Masius, Worcester, (Mass.) Polytechnic Institute.*

### Oil Switches, Locks for

All oil switches not equipped with disconnecting switches are now arranged so they can be locked open in such a manner that it is impossible to close them until the lock is removed. Locking devices are hereafter to be incorporated in the design of all new equipment of this nature.—*W. J. Ducey, Consumers' Power Company, Jackson, Mich.*

### Permeameter for Small Alternating-Current Magnetizing Forces

The purpose of the device is to test iron samples in ring form for communication circuits, at the same time avoiding the tedious process of placing a winding on each sample. The apparatus consists of a permanently wound iron ring with a secondary circuit made of one turn only. The ring under test is linked with this turn, and the inductance of the whole combination is determined by the usual alternating-current bridge method. For the theory and the construction details see *Journal Optical Society of America*, 1924, Vol. 8, p. 329.—*G. A. Kelsall, New York City.*

### Storage Batteries for Airplanes

In airplane service it is essential to obtain the largest possible current output with a minimum weight, and the total life of the battery is of relatively little importance as compared with high efficiency. At the request of the Bureau of Aeronautics tests have been made on airplane batteries produced by a number of companies, and the information gained has afforded a basis for the revision of the navy specifications for such batteries.—*Bureau of Standards, Washington, D. C.*

### Transformer Oil, Temperature-Warning Device

In this device a metal strip sensitive to heat is clamped tightly at both ends and has a contact washer situated at the point of its greatest deflection. This contact washer is equipped with an adjustable contact screw which makes contact at a certain temperature for which it is adjusted. The apparatus is placed in the transformer tank underneath the oil level and closes the circuit of an alarm or a signal lamp as soon as the specified temperature is reached.—*Allgemeine Elektricitäts - Gesellschaft, Berlin, Germany.*

## In Progress or Purposed

### Corrosion Tests on Non-Ferrous Metals

Four kinds of co-operative tests will be made—total immersion, alternate immersion, spray and accelerated electrolytic tests. Six metals and alloys (nickel, zinc, lead, copper, aluminum and admiralty metal) will be tested by each method, using the following six solutions: (1) sodium chloride, (2) hydrochloric acid (3) acetic acid, (4) sodium hydroxide, (5) ammonium hydroxide and (6) potassium dichromate. These tests are not being made to determine the relative corrosion resistance of any one metal or of any group of metals, the purpose being to compare and evaluate the various types of corrosion testing.—*American Society for Testing Materials, Philadelphia, Pa.*

### Heat Convection in Liquids

Photographs have been obtained in various liquids of convection streams from a heated wire. The amount of heat carried away has been measured and the exponent calculated according to which the loss varies with the temperature difference between the wire and the liquid. It is planned to continue the investigation with other liquids and also to determine the effect of the diameter of the wire. The first results have been published in the *Physical Review*, 1924, Vol. 23, p. 94.—*Roy Al Nelson, University of Illinois, Urbana, Ill.*

### Telephone Receivers, Cyclic Variations of Flux in

It is proposed to check the reliability of the usual theory by determining the relative extent to which the motion of the diaphragm, or equivalent part of the magnetic circuit, is accompanied by change in the total flux through the circuit and by change of leakage co-efficient. This relative change in flux will be determined by currents induced in coils at various locations.—*G. D. Shepardson, University of Minnesota, Minneapolis.*

## Suggestions for Research

### Agriculture, Uses of Electricity in

(1) On live-stock farms: feed grinders, corn shellers, hay balers, clipping machines, groomers, ice-cream freezers and cream separators; (2) on poultry farms: incubators, brooders, egg graders and egg candlers; (3) on fruit and vegetable farms: canners, dehydrators, fruit and vegetable curing machinery, sweet-potato curing, spray mixers, spray pumps and fruit-grading machinery; (4) for driving farming machinery: fertilizer mixers, ensilage cutters, seed graders, peanut pickers, gins, small grain harvesters and limestone crushers.

### Electroplating, Study of

A study of the effect of a base metal upon the metal electroplated upon it; a general study of the use of barium cyanide in improving copper plating; a method for finding the degree of adherence of electroplated metal; a method for electroplating a steel spring without causing it to lose its springiness.—*Dr. J. E. Zanetti, National Research Council, Washington, D. C.*

### Exciter, Turbine-Driven, Overspeed Device for

There have been several accidents with high-speed turbine-driven direct-current generators which were caused by motoring of the generator. Some member companies report the desirability of equipping such units with a relay operated by an overspeed device, in order to open the switch between the generator and the direct-current bus in case there is a tendency for the exciter to be motorized. This method of protection seems to be desirable, but there is room for improvement in the design of the overspeed device.—*Prime Movers Committee of the N. E. L. A.*

### Hydraulic Data on Spillways

When the operating engineer attempts to establish a rating curve for a spillway he finds a surprising lack of information. Both the theory and experimental data are inadequate, and a regrettable feature of the situation is that little progress seems to have been made in the last ten or fifteen years.—*R. L. Thomas (quoted by the Hydraulic Power Committee of the N. E. L. A.)*

### Hydro-Electric Plants, Forecasting of Water Supply for

No one can take up the study of the forecasting of water supply and fail to reach the conclusions that literature on the subject is very scarce, that many hydro operators are failing to take advantage of the knowledge that has been accumulated on the subject or are ignorant of it, that where water in storage is relied upon for generating purposes a knowledge in advance of probable inflow to reservoirs would be of great advantage, that in very many cases a fairly reliable forecast of water supply can be made by one method or another, and that the subject is deserving of further investigation and study.—*Hydraulic Power Committee of the N. E. L. A.* [Some practical methods of forecasting water supply will be found in the *N. E. L. A. Bulletin*, 1924, p. 57.]

### Semi-Vowel, Analysis of Sounds

The wave forms of four sounds, *l*, *m*, *n*, *ng*, as spoken six times each by two male voices, have been recorded by apparatus which was nearly free from distortion in frequency and phase over the interval from 80 cycles to 5,000 cycles. The results emphasize the vowel-like character of these sounds to such a degree that they deserve especial attention.—*I. B. Crandall, Western Electric Company, New York City.*

# News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

## New York State Joins Fight Against Chicago Canal

The State of New York has asked the Supreme Court for permission to file a brief in the appeal brought by the Sanitary District of Chicago to have set aside the decision of lower federal courts requiring it to reduce the quantity of water withdrawn from Lake Michigan. New York alleges that the present diversion of water from that lake interferes with the navigation of the St. Lawrence River, Lakes Erie and Ontario and the Barge Canal within New York State by lowering the level of those waterways, and that it is causing great loss to the state by diminishing the amount of water available for hydro-electric power in the Niagara and St. Lawrence Rivers. The court took the motion of the New York officials under advisement.

The bill proposing the withdrawal from Lake Michigan of 10,000 cu.ft. of water a second for the Chicago sewerage system was taken up on Tuesday of this week by the House rivers and harbors committee and arguments were made against it by State Attorney-General Dougherty of Michigan, Mayor Schwab of Buffalo and others.

## State Engineers Will Aid Plans for Interstate Power Flow

State engineers from a number of the commonwealths interested in superpower plans conferred with Secretary of Commerce Hoover on April 14, and it was agreed that they will lay before the public service commissions of their respective states the facts which have been developed. On the basis of these facts it is hoped that the public service commissions may be induced to suggest legislation which would facilitate and encourage the interstate flow of electrically produced power.

## Samuel Insull Gives Views on "Superpower"

Speaking in Philadelphia on Tuesday before the Bond Club of that city on "Superpower," Samuel Insull, president of the Commonwealth Edison Company of Chicago, defined the word as meaning the "more constant use of the invested dollar." By illustration he cited the situation in California, where as a result of interconnection and long-distance transmission the capacity factor of electric power plants of the state is about 46 per cent as compared with about 15 per cent in states where there is little or no "superpower" development.

The club had as its guests officers of a number of utility companies and other executives. These included Joseph B. McCall, president of the Philadelphia Electric Company; Samuel T. Bodine, president of the United Gas Improvement Company; Herbert Lloyd, president of the Electric Storage Battery Company; Thomas N. McCarter, president of the Public Service Corporation of New Jersey; George N. Tidd, president of the American Gas & Electric Company, and W. S. Barstow, president of the General Gas & Electric Company.

## Illinois Electric Power Company's Peoria Plant

Work has begun on the Illinois Electric Power Company's steam plant on the Illinois River opposite Peoria. This plant will eventually have five units with a generating capacity of 100,000 kw. The part now under construction will have two 20,000-kw. turbo-generators, each served by two boilers fired with powdered coal and to operate at a steam pressure of 350 lb. to 400 lb. and superheat of 250 deg. F.

In the generating end of the plant some interesting features are to be incorporated. The main units are rated at 25,000 kva. and are capable of carrying 23,500 kw., with maximum stage bleeding from four different points. The house generator is carried on the shaft of the main unit, and on the end of the house-generator shaft is an exciter serving the house generator only. The main generator is to be excited at 250 volts from motor-generator sets supplied from the house generator. Circulating, condensate and boiler-feed pumps are supplied from the house generators; the rest of the auxiliaries draw from the main bus through transformers. Normally, each house generator will supply the auxiliaries for its particular turbo-generator, but in case of failure of the house generator these auxiliaries may be operated from the main bus, the circuits being supplied with interlocking switches so that a change-over can be effected without dropping the load or paralleling the house generator with the main bus.

Current will be generated at 13,200 volts, and that portion of it intended for local consumption will be sent across the river at this voltage through submarine cables to the Peoria plant. Another portion of the station output will be stepped up to 132,000 volts to supply the Illinois Power Company at Springfield, Ill., 70 miles south. The engineering is being done by the local organization, which is allied with the Central Illinois Light Company.

## Great Falls of Potomac Bill Passes Senate

Without a single voice raised in objection, the United States Senate on April 10, without a roll call, passed the Norris bill providing for the development of the Great Falls of the Potomac, near Washington. This is the third time the Senate has passed this bill. One of the previous bills died in the House with the end of the session of Congress. The other reached the conference stage but resulted in a compromise whereby a further report was to be made. This was the report made by Major Max Tyler and noted in the ELECTRICAL WORLD for March 8, page 496.

There will be objection to this bill in the House on the ground that an expenditure of $45,000,000 is not justified at this time. Passage of the bill by the Senate during the first session of Congress increases the chances of its ultimate success. The bill as passed by the Senate authorizes the Secretary of War to undertake the development along the lines indicated in the Tyler report, but the Federal Power Commission is authorized to make any modifications or changes in the Tyler plans that will increase the maximum amount of power which can be developed.

## Bankers' Shares Offered on Edison Company Stocks

Offering will be made shortly in the New York and London markets of bankers' shares representing the stocks of ten of the leading Edison companies operating in New York, Chicago, Detroit, Cleveland, Boston, St. Louis, Milwaukee, Los Angeles and other cities. The bankers' shares will be offered for public subscription by a selling group managed by Bonner, Brooks & Company of New York and by the British & General Debenture Trust Limited of London. The holding company for the shares acquired and deposited in trust, against which the bankers' shares are issued, will be known as the United American Electric Companies, Inc.

Through a trust agreement with the Empire Trust Company of New York, made in perpetuity and which provides that no substitution of securities may be made, shares of the following Edison companies are asserted to have been deposited: Brooklyn Edison Company, Commonwealth Edison Company, American Power & Light Company (controls Duluth Edison Company), Detroit Edison Company, Metropolitan Edison Company, Consolidated Gas Company of New York (controls New

York Edison Company), Edison Electric Illuminating Company of Boston, Edison Electric Illuminating Company of Brockton, North American Company (controls North American Edison Company and Wisconsin Edison Company), and the Southern California Edison Company.

Under the agreement shares in blocks of 190 shares each, totaling $10,000 par value, are deposited with the trust company. Against each of such blocks 1,000 bankers' shares of the par value of $10 each are issued in the form of bearer certificates, with dividend coupons attached, in denominations of five, ten, twenty-five and a hundred share certificates. Under the provision of the trust agreement the holders of bankers' shares have the right, upon two months' notice prior to any dividend date, to surrender their bankers' shares in blocks of 1,000 shares and receive therefor one block of deposited stocks of 190 shares of the total par value of $10,000.

So far as the ELECTRICAL WORLD is able to learn, none of the Edison companies enumerated has any connection with the plan or knows anything about it. The scheme is not new, having been tried before in this country and being quite common in England.

# Light and Power Fed from Same Network

## Memphis Company Adopts Three-Phase, Four-Wire Secondaries—Arrangements to Make Transformer Share Load— Network Protector Switches—200 Volts Not Objectionable

WORK is well under way by the Memphis Power & Light Company for converting the entire underground alternating-current secondary system to a three-phase, four-wire network which will supply 115 volts and 200 volts for light and power respectively. This system, it is reported, will after the incorporation of refinements for obtaining greater reliability of service and protection be the first of its kind in the United States. It has been chosen because the company believes it affords the least expensive way of rendering reliably both light and power service, or, to look at it another way, affords the best opportunities for economically increasing the capacity of the system and rendering the most reliable continuity of service. To eliminate the objections which have been raised to such a system, provisions will be made to have the transformers share the load, and special network protector switches will be employed to isolate faults.

Two hundred volts for power is not considered objectionable for existing 220-volt motors, and investigators even believe it to be an advantage, because it will enable loading up the over-capacity motors on the system, most of which have been installed with entirely too large a margin of safety. As a result the power factor will be improved and customers' demand factors reduced, thus permitting better rates. If further investigation or experience shows that any motors cannot be operated satisfactorily at the reduced voltage, auto-transformers will be installed to raise the voltage for these particular units. On the assumption that all the motors would require higher voltage, the cost of auto-transformers has been calculated to be less than putting in separate systems for light and power. Since the underground system does not serve an industrial district, it appears that the number of auto-transformers that will be required will not cost more than 10 per cent of what it would cost to provide a special power system. Besides, one of the three underground systems which the Memphis Power & Light Company inherited from its predecessors has been operating as a three-phase, four-wire 115-200-volt light and power system for about ten years.

The part of the existing system which is thus operating uses four-conductor, 300,000-circ. mil cable. The second of the three inherited systems is a single-phase, three-wire, 115-230-volt system consisting of one two-conductor, 250,000-circ. mil cable paralleled by one bare 250,000-circ. mil wire. The third system is a three-phase, three-wire, 230-volt system including various sizes of double-conductor cable paralleled by a bare wire. The first two systems are sufficiently good to retain as parts of the new system, the second requiring only another single-conductor cable in parallel with it to permit operation as a three-phase, four-wire system. When this is converted, the three-phase load on the third system will be transferred to it and the third system will be removed from the street because of its non-uniform character.

### SIX CIRCUITS TO BE USED

In laying out the primaries to feed this network six circuits will be used. Instead of having each circuit feed a different district, their transformer tap points will be interlaced so that if one circuit is interrupted the adjacent transformers fed from another primary circuit will keep the secondary network energized. This arrangement will also enable cutting off part of the primary circuits during light load, thereby minimizing transformer losses. Isolation of any fault in the network will be accomplished by the network protector switches. Faults in the primary circuit can be readily located and removed, because junction-box switches will be provided at the junction point between the primary lead and branches running to the transformers, thus permitting cutting out any branch to find the source of trouble.

For important buildings in which interruption of service would be a serious public inconvenience duplicate primary feeds will be provided with automatic throw-over switches and network protector switches between the secondary side and the system network. In such installations two banks of transformers each carrying half the building load will be installed, one connected to each throw-over switch. Thus when a primary circuit is interrupted the secondary side of the transformer will still be fed from the system secondary network during the moment while the automatic throw-over switch connects the transformer to the other primary.

To prevent any one transformer or a few transformers taking all or the greater portion of the load in case a fault develops on the system, iron-core reactors are provided in the secondary leads from each transformer which will raise the reactance per transformer to 10 per cent. This scheme, it has been calculated, will make the conductor impedance relatively negligible, and therefore the transformers will share the load more nearly in proportion to their ratings. The reactor consists of nothing more than a split iron core with the two secondary leads of the transformer run through it in opposite directions. It has an approximately straight-line characteristic.

In addition to the foregoing changes, the Memphis company is raising its primary voltage from 6,600 volts to 11,800 volts and employing 11,800-volt generators to avoid transformer losses and obtain the advantages of higher voltage transmission.

## Two Millions to Be Spent on Memphis Property

Expenditures of the Memphis Power & Light Company during the year 1924 will come to about $650,000 and $2,000,000 for uncompleted and new work respectively. The uncompleted work includes the finishing of a 15,000-kw. extension to the Fourth Street generating station, moving a 7,500-kw. turbine from the old Beale Street station to this plant, completing two substations, finishing some underground extensions and changing the primary distribution from 7 kv. to 11 kv. About 50 per cent of the expense for new work will be required for a 20,000-kw. extension to the Fourth Street generating station, 25 per cent for extensions to and improvements of overhead and underground services including meters and transformers, 25 per cent for a new central storehouse for the gas, railway and electric departments, and the remainder for a new substation and miscellaneous equipment. This is a part of the plan which the Electric Bond & Share Company, fiscal agent for the National Power & Light Company, which in turn controls the Memphis company, expects to carry out to bring the Memphis system and the service it renders up to this highest class.

## Engineering Council to Have Strong Committees

Leading engineers, economists, educators and industrialists will direct the public service activities of the American Engineering Council, according to an announcement by the president of the council, ex-Governor James Hartness of Vermont. Among these, it will be seen below, are prominent members of the American Institute of Electrical Engineers, including seven ex-presidents.

William McClellan, formerly dean of the Wharton School of the University of Pennsylvania, is made chairman of the federal power committee, the members of which are E. B. Katte of New

York, C. G. Adsit of Atlanta, F. G. Baum of San Francisco, Erskine Ramsay of Birmingham, C. C. Thomas of Los Angeles and J. H. Finney of Washington.

Calvert Townley of New York, vice-president of the Westinghouse Electric & Manufacturing Company, is named chairman of the public affairs committee, other members of which are L. P. Alford and F. B. Jewett of New York, Prof. D. C. Jackson of the Massachusetts Institute of Technology and Fred J. Miller, member of the Pennsylvania Public Service Commission.

Gardner S. Williams of Ann Arbor, Mich., heads the committee on government reorganization as related to engineering matters, of which the other members are Francis Blossom, L. B. Stillwell and J. Parke Channing of New York, J. H. Finney of Washington, John Lyle Harrington of Kansas City, P. N. Moore of St. Louis, Max Toltz of St. Paul and Hunter McDonald of Nashville.

Other heads of committees are: Reforestation and timber supply, J. C. Ralston, Spokane, Wash.; patents, E. J. Prindle, New York; elimination of waste in industry, F. K. Copeland, Chicago; War Department personnel, Dean Arthur M. Greene, Jr., of Princeton University; contracts and adjustments, Max Toltz, St. Paul. S. M. Kennedy of Los Angeles is a member of the first-named committee, E. W. Rice, Jr., and Charles A. Terry of the second, Prof. C. F. Scott, President S. W. Stratton, F. L. Hutchinson and E. W. Eales of the fourth, and Prof. Comfort A. Adams and H. M. Southgate of the fifth.

Calvert Townley and Fred R. Low of New York and John H. Finney of Washington have been appointed delegates to the World Power Conference in London. W. R. Ingalls, New York mining engineer and economist, is the council's representative on the National Bureau of Economic Research. Rudolph P. Miller of New York was reappointed to the National Board for Jurisdictional Awards.

## Nearly Eight Millions Saved to California Users

Savings of $7,791,035 to the payers of electric rates in California are claimed by the Railroad Commission of that state to have resulted from reductions in 1922 and 1923. In the case of some companies two reductions have been made in the period named. The commission tabulates these savings as follows:

APPROXIMATE REDUCTION OF REVENUE

| Company | Per Cent | Amount |
|---|---|---|
| Southern California Edison | 10 | $1,610,000 |
| Southern California Edison | 12 | 2,200,000 |
| San Joaquin Light & Power | 4.4 | 241,700 |
| San Joaquin Light & Power | 2.25 | 135,000 |
| San Diego Con. Gas & Electric | 8.8 | 219,835 |
| Coast Valleys Gas & Electric | 8.3 | 40,000 |
| Coast Counties Gas & Electric | 14 | 94,000 |
| Pacific Gas & Electric | 10.8 | 2,600,000 |
| Great Western Power | 10 | 567,000 |
| Southern Sierras Power | 1.65 | 30,000 |
| California Telephone & Light | 7 | 19,000 |
| Ojai Power Company | 10 | 3,000 |
| Midland Counties Public Service Corporation | 3.7 | 31,500 |
| Total | | $7,791,035 |

## Senate Hearings Begin

### Elon H. Hooker Explains His Muscle Shoals Bid to Committee—Much Testimony to Be Given

HEARINGS on the various proposals for the disposition of the government's hydro-electric projects at Muscle Shoals, Ala., opened before the Senate committee on agriculture and forestry on April 16 with Elon H. Hooker, president of the Hooker Electrochemical Company, as the first witness. The committee has arranged a tentative program which will carry the hearings through April 29, and the probabilities are that it will not be possible to conclude even on that date.

Senator Norris, chairman of the committee, at the opening of the hearings announced his policy as being that there should be full opportunity for all proposals to be presented in detail before the committee. Previously the committee had reversed its prior announcement that no testimony regarding the Henry Ford offer would be heard and had voted to invite Mr. Ford to appear in person or to send an authorized representative to explain certain features of his bid. It is understood that several members of the committee are particularly anxious to have on record an authorized expression of Mr. Ford's intentions regarding the use of all the hydro-electric power which will be developed.

Among many witnesses who are expected to appear before the committee are prominent engineers, chemists and representatives of industry. Governor Pinchot of Pennsylvania, ex-Secretaries Newton D. Baker and David B. Houston and Dr. Harry A. Garfield will also be called on for their views.

In testifying before the committee, Mr. Hooker, whose proposal involves government co-operation, explained that his offer contemplated maximum production and distribution of cheap fertilizer with an estimated saving to farmers of $30,000,000 a year and a return to the government of $305,000,000 in fifty years. The government would furnish all the capital for the operations and the company would put in $1,000,000 as evidence of good faith, relieving the government at once of construction, operation, research and manufacture. The government would receive 75 per cent of the profits and 25 per cent would go to the company from fertilizer operations. Title of all properties would be made in the name of the government, Mr. Hooker said.

Associated with the Hooker company in its bid are J. G. White of New York, who constructed two of the Muscle Shoals units for the government, and W. W. Atterbury, vice-president of the Pennsylvania Railroad.

## A. E. C. Committee Will Investigate Muscle Shoals

In compliance with a request from Senator Norris, the chairman of the Senate agricultural committee, the American Engineering Council has chosen a committee to make a report on the disposition of the government's Muscle Shoals properties. The committee is composed as follows: F. R. Low, New York, president American Society Mechanical Engineers; H. E. Howe, Washington, American Chemical Society; J. B. Davidson, University of Iowa, agricultural engineer; H. B. Walker, Agricultural and Mechanical College of Kansas, agricultural engineer; P. N. Moore, St. Louis, mining engineer; E. B. Whitman, Baltimore, chairman Maryland Public Utilities Commission; H. W. Buck, New York, electrical engineer; Dr. Leonard Waldo, New York, mining engineer. The committee held its first meeting in Washington April 15.

## Representative Burton Attacks Ford Offer

One of the ablest and most determined Congressional opponents of the McKenzie bill accepting Henry Ford's offer for Muscle Shoals is Representative Theodore E. Burton of Ohio. Mr. Burton has issued a statement giving the grounds of his opposition and especially emphasizing his belief that to give Muscle Shoals to Ford would injure the industrial progress of the Southern States everywhere save in the district immediately adjacent to the Detroit manufacturer's proposed development. Mr. Burton says in part:

"The difficulty in dealing with the so-called Ford proposal lies in the fact that the main issue is completely masked behind a smoke screen of doing something for the farmer. . . . The real issue is the established policy of the United States relating to water power, particularly as embodied in the water-power act of 1920. The statute had the most careful consideration of three administrations. The Ford offer either violates or ignores almost every provision of this act. The McKenzie bill is altogether out of keeping with a policy of conservation, and those who are opposed to waste and opposed to monopoly cannot consistently be anything but opposed to it.

"In this connection it has been argued most strenuously that if the Ford corporation gets Muscle Shoals it will greatly stimulate the industrial development of the South. If this were true, I would be the last to oppose the contract. If Mr. Ford were willing to submit to the provisions of the federal water-power act, then this might be the result. As it is I honestly believe it will have exactly the contrary effect and will only result in tremendous industrial activity in northern Alabama due to the Ford enterprises, which will be built around the second largest block of cheap power on the American continent. Southern Alabama, North Carolina, South Carolina, Georgia, Mississippi and Tennessee will be benefited not at all. On the contrary, this territory will be seriously handicapped.

"Of course Mr. Ford, if his corporation gets control of Muscle Shoals under the terms of his offer, will build up an industrial community around it. That is what he wants it for. He would not be the great industrialist that he is if he did not. That this is going to help northern Alabama I will admit, but it is not going to help the rest of the South and it is not going to help the present existing Southern industry."

# National Home-Lighting Campaign

## Its Inauguration Announced at Joint Meeting of Middle West N.E.L.A. and Missouri Association—Rural Service, Commercial Subjects and Public Relations

THE outstanding event of the second annual Middle West Division convention of the National Electric Light Association, held in conjunction with the Missouri Association of Public Utilities and attended by more than three hundred delegates at Kansas City last week, was the announcement by J. E. Davidson, vice-president of the N. E. L. A., of the nation-wide home-lighting campaign foreshadowed in the ELECTRICAL WORLD for March 29, page 638. This movement is in pursuance of a forward-looking program involving better illumination of residences and the conservation of eyesight. Mr. Davidson briefly outlined the detail plans of his lighting educational committee, which will give lectures and promote essay contests in schools on good illumination, besides obtaining the support of local members of the electrical industry and of architects. Prizes are to be offered consisting of three electrical homes costing from $5,000 to $15,000 and built wherever the prize winners designate. Intensive effort will be spent in making this a national movement to create more interest in lighting in the twelve million American homes.

The opening sessions of the Middle West convention were reported last week. The session on Thursday morning of the Missouri Utility Association was devoted to an open question-box discussion. Stanley Stokes, St. Louis, brought up the subject of the possibility of an extensive development of water power in Missouri by declaring that hydro-electricity would not be economical as primary power owing to the intermittent flow of Missouri streams.

F. T. Porter, Kansas City, speaking on relative rates in towns having generating plants and in places where service comes from transmission lines, favored uniformity because it simplifies accounting and also because it arouses a more cordial feeling in towns of the second class.

The following officers of the Missouri Utility Association were chosen for 1924: President, C. L. Proctor of Joplin; vice-presidents, W. F. Corl of St. Louis, E. D. Bell of St. Louis, F. S. Dewey of Kansas City; secretary and treasurer, F. D. Beardslee of St. Louis. The executive committee will contain also H. Spoehrer of St. Louis and William Hand of Kansas City.

### PUBLIC RELATIONS DAY

Thursday afternoon for the Middle West Division was public relations day, and E. D. Bell reviewed the year's work along these lines and pleaded for its continuation. In Missouri, he said, utility advertising in newspapers had been increased 2,000 per cent.

Miss Isabell Davie, chairman of the Iowa Women's Division, said that the public utility women of Iowa were building a strong foundation for the betterment of public relations. Kansas, Iowa, Nebraska and Missouri have each organized women's divisions for this work, and they held quarterly meetings in 1923.

George A. Hughes, Chicago, dealt in an able paper with some present-day problems, explaining that these were no longer of a material nature but involved the resources of the human mind. From this standpoint he showed how a public utility manager's post called for ability in clearly presenting his problems to the public and not so much as in the past for control of engineering details.

Two talks on insurance problems were made by Henry S. Ives and C. B. Scott, both of Chicago. Mr. Ives condemned the motives behind the insurance-at-cost idea and placed it in the same category as municipal ownership. Mr. Scott, after studying methods of reducing insurance rates, felt that a 30 per cent reduction could be obtained if the physical property was well investigated and hazards were reduced. If rates are too high, the fact should be considered a reflection upon the management. He spoke on the program of the N. E. L. A. insurance committee, which for 1924 is to study the best methods of instituting group life insurance among public utility employees.

### FAVOR RURAL RESEARCH

A discussion of rural electrification was opened Friday morning by Arthur Huntington, Cedar Rapids, who outlined the results of the year's work. He drew attention to the fact that the utilities were the only business organizations which had a similar turnover of investment to that of the farmers. Where a utility turnover might come once in five to seven years, the farmer's would be accomplished once in eight to ten years. This similarity, he thought, should be a vital factor in analyzing the rates for the service rendered. Mr. Huntington also spoke of the work started by the Committee on Relation of Electricity to Agriculture in determining further uses of energy on the farm by the installation of experimental farms completely electrified.

Dr. J. B. Davidson, Iowa Agricultural College, Ames, declared that an increased use of energy must come through greater economies now not known and that a sound, definite research program must be worked out in order to determine the field of electrical applications to rural problems. Other university professors who discussed this subject were William M. Jardine, president Kansas Agricultural College; E. E. Brackett, Nebraska Agricultural College, and Professor Jones, Missouri Agricultural College. They expressed approval of the work now being done by the committee under Dr. E. A. White's direction in forming local state committees on relation of electricity to agriculture.

J. B. Hill, Lincoln, Neb., outlined three principles guiding the relationship of educational institutions with public utilities—first, technical training for engineering students for utility operation; second, co-operative research work, which was hampered by its slowness and lack of money; third, explanation of underlying public utility principles. J. B. Sheridan, director Missouri Committee on Utility Information, pointed out the absolute need of rewriting some school textbooks, where he found prejudiced assertions.

### COMMERCIAL SECTION'S NEED

N. T. Wilcox, Boston, chairman National Commercial Section, declared at the Commercial Section meeting Friday afternoon that the industry's greatest need for the next ten years would be the development of an efficient sales staff. He compared the advantages, from an energy standpoint, of various types of appliances ranging from vacuum cleaners to water heaters. Although fewer flatirons are being sold, according to Mr. Wilcox, than washing machines and vacuum cleaners, the net revenue to the central stations from irons is greater.

In the discussion J. L. Harvey, Wichita, Kan., pointed out that the $60 revenue per year from either a range or refrigerator would bring in enough money to lower materially the turnover of distribution investment. F. S. Dewey, Kansas City, referred to the economies of operation in cement and flour mills, which produce their products on 16 kw.-hr. and 7¼ kw.-hr. respectively.

W. S. Vivian made a stirring public relations talk and told of extraordinary misconceptions prevalent in some high schools, where he had heard that public utility corporations were the common public enemy and that it was legitimate to steal from these corporations. He considered talks by trained employees to social groups to be a good means of combating such ideas.

Pitfalls of customer-ownership stock campaigns were thoroughly discussed by P. H. Whiting, New York, who favored the short ten-day period of sales rather than a long campaign. His requirements for a successful stock-selling campaign were only three—ample effective advertising, getting the calls made, and remuneration for every one taking part.

H. G. Taylor, president National Association of Public Utility Commissioners, Lincoln, Neb., declared that the greatest problem in regulation today was the maintenance of a balance between independent initiative and the stagnation of municipal ownership. M. H. Aylesworth, managing director N. E. L. A., pointed out the dangers from laxness in refuting municipal-ownership advocates.

### BYLAWS AND OFFICERS

Since only a tentative constitution and bylaws had been drawn up last year at the organization of the Middle West Division, a new set, patterned after those of the Great Lakes Section, was adopted. The new officers are: President, L. O. Ripley, Wichita, Kan.; vice-presidents, B. J. Denman, Davenport, Iowa; F. H. Brooks, Omaha, Neb., and F. B. Irelan, St. Joseph, Mo.; secretary-treasurer, Horace M. Davis, Lincoln, Neb.

## New Englanders Boom Electric Vehicles

Addresses upon the economic sphere of the electric vehicle were made at a dinner and meeting under the auspices of the Transportation Bureau of the New England Division, N. E. L. A., at the Boston City Club, on March 26, with Samuel Ferguson, president of the New England Division, La Rue Vredenburgh, Boston, was toastmaster.

E. S. Mansfield, Boston Edison company, outlined plans for an electric transportation school to be held in Boston this spring. Charles R. Skinner, Jr., of New York, chairman N. E. L. A. Transportation Bureau, said that electric vehicle sales in February, 1924, in New York City exceeded the sales of the three leading makes of gasoline trucks, outlined the spread of the electric truck movement throughout the larger cities of the country and predicted a noteworthy increase in installations this year. E. Travers of the White Cross Laundry, Somerville, Mass., gave enthusiastic testimony as to the economy of electric delivery wagons, declaring this method to be the most satisfactory the company has ever known. Daily runs of 30 miles to 33 miles are obtained on bare roads, and when snow existed on the highways a boosting charge at noon enabled the service to be completed satisfactorily. Within two years this company expects to replace all horse-drawn and gasoline vehicles with "electrics" with the exception of six gasoline cars for long hauls. N. E. Whittemore, Ginter Company, Boston, also spoke on the field of the electric truck.

## Vast Market Is Predicted for Electrical Refrigeration

Before the Appliance Bureau of the New England Division, N. E. L. A., at Boston, recently George M. Dwelley, vice-president of the Kelvinator Corporation, Detroit, declared that the modern ice company is beginning to see the handwriting on the wall in the advance of electrical refrigeration into the home, and that the prospective market for such machinery is measured by the households that have discarded or will discard coal ranges for electric or gas ranges. Because of mechanical refrigeration one large ice company in New York, the speaker said, has started a sinking fund of a million dollars a year to enable it to retire from business in 1938. Twenty thousand domestic machines had been sold by the speaker's company in the past decade, he said, and the demand is rapidly increasing.

Discussing the general problem of developing and marketing domestic refrigerating equipment, Mr. Dwelley dwelt on the need of ample capital, ability, experience, almost unlimited patience and first-class design and construction. The Kelvinator company spent more than $800,000 before it turned the corner and began to make a profit, he asserted. In the company's "morgue" are particulars of no less than 158 defunct machines which failed to find a successful market in the past three years. Sixty-five million dollars have been expended by American manufacturers to put electrical refrigeration "on the map." In 1922 the Kelvinator company's national average of service calls was one and nine-tenths per machine. In emphasizing the attractiveness of such a load for the central station the speaker urged selling such apparatus for its service value instead of featuring the equipment itself.

## Electrical Engineering Convention for Paris in July

A convention of "producers and distributors of electrical energy" is to be held in Paris next July, probably immediately after the World Power Conference in London, which closes July 12. The coming Paris convention, at which American representation has been solicited by the Syndicat Professionnel des Producteurs et Distributeurs d'Energie Electrique in a communication to Dr. C. O. Mailloux, honorary president of the International Electrotechnical Commission, will have a program quite different from the one followed by the high-tension conference held in the French capital last November. Whereas the latter conference expressly confined its attention to very high tensions, the forthcoming convention will devote itself to the discussion of systems of medium and low voltages, not exceeding 60,000. Furthermore, the convention will constitute a gathering of specialists and practical men identified with electrical supply systems for the purpose of discussing methods of design and operation and the results obtained. Manufacturers of electrical machinery and apparatus will be excluded. As the convention will not be, strictly speaking, international, only one language will be used—French.

The following are some of the principal subjects that will be considered:

Rates of charge for electrical energy for rural systems.

Rural installations: Use of the ground-return circuit for certain high-voltage lines; three-phase transformers; importance of solidity of construction; advantages and disadvantages of 230 volts with regard to the ground.

Protection or safeguards against short circuits and accidental ground connections.

Utilization of electrical energy at night; diversity.

Means of communication for high-tension systems.

Transformer substations of moderate power; indoor type, semi-outdoor type and outdoor type.

Location of defects on transmission and distribution systems of medium voltage.

Rights-of-way for electrical lines on private property.

Improvement of the power factor.

Development of domestic uses of electricity.

Use of storage batteries for electric vehicles.

Replacing and preservation of wooden poles.

Small transformer stations on poles.

Limits of capacity of transformer stations; double transformers with automatic switch for service connection.

Ground return; bimetallic conductors.

Reports prepared in advance on these and other topics will be printed and sent to all members of the congress to enable them to prepare discussions and communications. Suggestions will be received in regard to other topics that may be deemed of interest. Dr. Mailloux will be glad to hear as soon as possible from all who will attend.

## Interstate Company May Buy City Plant of Richmond, Ind.

The Interstate Public Service Company, through Harry Reid of Indianapolis, its president, has made a formal offer to the City Council of Richmond, Ind., to purchase the municipal electric light plant at a price of $1,500,000. The Richmond utility has no competition in the production and distribution of electrical energy and is considered one of the best-managed municipally owned plants in the country. Its physical equipment is in good condition and its earning power has been increasing steadily. Six months ago a reduction in rates was effected and a petition now is pending with the Indiana Public Service Commission asking for a further decrease of 10 per cent in all classifications.

The City Council referred the offer to its public service committee and instructed Mayor L. A. Handley to appoint a citizens' committee to co-operate in an investigation of the Interstate's offer. It seems likely that if there is a disposition to accept the offer, final decision will be left to the citizens in a referendum election. The municipal light plant has been regarded by many as one of the big assets of the municipality. Some fear rates will be increased if the property is sold. Many citizens, on the other hand, are of the opinion that the development of big central electric stations will in a short time make it almost impossible for an isolated municipal plant to compete successfully as far as rates for service are concerned, and for that reason favor selling the plant.

## Excellent Reports for 1923 Still Come In

The Philadelphia Electric Company reports for 1923 a net income of $6,805,259, equivalent, after preferred dividends, to $2.88 per share on the outstanding common stock of $25 par value. In 1922 $3.03 was earned per share. Gross earnings were $27,609,189 last year, against $23,520,612 in 1922.

The Tennessee Electric Power Company reports for 1923 a consolidated net income of $2,437,895 and a surplus after preferred dividends and depreciation of $910,327, equal to $18.10 a share on the 50,000 shares of second preferred stock and $3.91 per share on the 156,000 shares of common stock.

The California Oregon Power Company reports that its electric operating revenue for the year 1923 was $1,267,212 and electric operating expenses $740,449, giving a net operating revenue of $526,762. The company declared dividends of $194,513 during the year, leaving an accumulated surplus at the end of the year of $195,146.

The West Penn Power Company and subsidiaries shows for 1923 gross operating earnings of $11,978,606, operating expenses including taxes of $8,299,616, and a net income after deductions for interest, etc., of $2,660,990. Its output for last year was 944,562,856 kw.-hr., as compared with 742,878,248 kw.-hr. in 1923.

## Irrigation and Electricity

### Fact-Finding Committee Reports on Possibilities of Project Plants and Other Power Sites

THE report made to the Department of the Interior by the special advisory committee on reclamation—a ponderous document of 300 typewritten pages—contains the following paragraphs dealing with project power plants and the possibilities incidental to irrigation works of furnishing other power to rural consumers. These paragraphs, which were not included in the official abstract of the committee's report prepared for the press, will be of interest to light and power men in the sections concerned because of their bearing on future developments in the irrigation districts:

"In the construction of the federal irrigation projects it was found that the power required for construction could best be secured by the construction of power plants, usually hydro-electric plants. When construction was completed the cost of these power plants, yet in good working condition, was included in the construction cost of the project. Usually, these power plants, after having served as adjuncts to construction, have been left on the projects. The power produced by them has been used for pumping water to higher lands or for drainage, and the excess over and above the needs of project operation has been sold for general industrial purposes.

"On eleven of the projects there are eighteen power plants, which have cost the reclamation fund $3,825,905. These power plants had an output during the fiscal year 1922-23 of 177,038,638 kw.-hr. A part of this power, 93,660,469 kw.-hr., was sold to consumers, and another part, about 37,067,575 kw.-hr., was used for irrigation purposes. The net revenue for the fiscal year ended June 30, 1923, was $584,930. The service of these plants has not yet reached its full possibilities, neither has the possible service of power on the prospective projects been fully developed.

"Several of these power plants are operated by canal water during the irrigation season and are therefore idle in the winter. During the growing season when the canals are filled with water the output of power is therefore greatest, which permits a larger use for pumping purposes to supply high-lying lands with water.

#### OTHER POWER POSSIBILITIES

"In addition to the project power plants already constructed, there are many power possibilities that will be used in the future. The building of irrigation works, implying the diverting of water from high-lying to lower-lying lands, necessarily furnishes power opportunities. On some projects these power opportunities are very large. The increasing need for power on the farm throughout the year and on the project for pumping purposes during the summer makes it very certain that as time goes on these many power possibilities will be more carefully scrutinized with a view of constructing additional power plants.

"The place of power in modern agriculture has been well established. The electric current has become the servant of the farmer, by the aid of which one man is enabled to do several times the work that the farmer of old could do. The need for power on an irrigated farm is as legitimate as the need for water. Any future policy relative to the development of federal reclamation should keep the power problem in mind. The water users, when they take over a project, should be allowed to operate the whole project as a unit, including the power plants that may be constructed—and, further, no reservations should be made regarding possible power sites, except as to the permanent retention of existing power possibilities for the use of the project population."

## Briefer News

**Rates for Large Consumers Cut in Cleveland.**—Cuts in rates for electrical energy to apply to all wholesale, commercial and industrial users, which will reduce the amount collected from 1,500 of the largest users about $900,000 yearly, have been announced by the Cleveland Electric Illuminating Company. For the first 2,500 kw.-hr. the new rate will be 3 cents instead of 3.3 cents, for the next 37,500 kw.-hr. 1.5 cents instead of 1.7 cents, for the next 60,000 kw.-hr. 1 cent and above 100,000 kw.-hr. 0.85 cent instead of 1.125 cents for all above 40,000 kw.-hr.

**Electric Ship Drive Again Proves Its Worth.**—Twice around the world and twice to Japan and back, a total distance of 150,000 miles, without the slighest mishap to its electrical propulsion equipment despite the fact that on its last voyage the ship was at the mercy of a typhoon for six hours, is the record of the S.S. *Archer*, cargo carrier of the Barber line. The only expense to the equipment since the turbine electric drive was installed by the General Electric Company in the fall of 1921 has been the renewal of brushes on one of the generators, a cost of $4.

**Wisconsin Valley Interests Buy Plants in Three Other States.**—Consolidation under the same control of three large electric light and power plants in three states has just been completed, according to C. C. Yawkey, president of the Wisconsin Valley Electric Company, which operates in Wausau, Stevens Point, Merrill, Tomahawk and other places in Wisconsin. A syndicate composed of Mr. Yawkey and others has purchased the Minnesota Electric Light & Power Company, serving Bemidja, Minn., and Cushing, Okla.; the Cass Lake Water, Light & Power Company, furnishing power service to Cass Lake, Minn., and the Eastern Montana Light & Power Company, which serves Glendive, Mont., and communities near by. The headquarters of the combined companies will be at Minneapolis, with C. C. Yawkey as president and R. M. Haskett as vice-president in charge of operations.

**Manchester Utility Undertakes Hydro-Electric Plant Improvements.**—The Manchester (N. H.) Traction, Light & Power Company has awarded a contract to Stone & Webster, Inc., Boston, for the installation of vertical hydraulic turbine units of 2,400-kw. and 3,200-kw. rating at its Garvins Falls station on the Merrimac River, and of one 1,000-kw. vertical unit at Kelly's Falls on the Piscataquog River. Specifications will probably call for propeller-type runners, and it is planned to install full-automatic electric control at Kelly's Falls, with additional provision for operating supervision from the adjacent steam plant of the company.

**Proposed Tax on Radio Sets Strongly Opposed.**—A storm of opposition has arisen in Congress, as well as outside, against the action of the Senate finance committee in including in the revenue revision bill a provision for a tax of 10 per cent upon all radio sets and parts. The committee estimated that the radio tax would yield $12,000,000 annual revenue. President Coolidge has declared himself opposed to any new taxes. Secretary of Commerce Hoover expressed opposition to the radio tax as soon as it was voted into the bill. It is believed that the Senate will strike the tax from the bill, but if this is not done, the House conferees are expected to insist upon its elimination.

**Unity - Power - Factor Installation to Be Made.**—The Hebron Manufacturing Company is building a new plant at Toledo, Ohio, for the manufacture of drop forgings, and the electrical drive is designed to permit operation at unity power factor over virtually the entire load range. This performance is sought through the use of an equal number of Fynn-Weichsel and ordinary squirrel-cage motors. The special motors are used to compensate for the low power factor of the squirrel-cage motors. This is the first entirely new installation which has been worked out by engineers of the Wagner Electric Corporation, and results obtained in service will undoubtedly be closely watched by many engineers.

**Buffalo General Electric's Three-Million-Dollar Program.**—The Buffalo General Electric Company has announced a three-million-dollar construction program for the present year. This will include the building of two new substations, one of which is now under way, and improvements in existing equipment. One of the new substations, which will be completed shortly, will have a capacity of 40,000 kw. This station is on the Hamburg Turnpike and will serve Buffalo's milling, shipping and transportation industries in that vicinity. The second substation will be in the northern part of the city and will serve such firms as the American Radiator Company and the Pierce-Arrow Company. Other contemplated improvements include two new underground high-tension distributing lines, with a capacity of 22,000 volts each.

**Utility Taxes Going Down in Wisconsin.**—For the first time in many years public utility companies and their customers are going to experience a decrease instead of an increase in their tax rate over that of the previous year, according to J. N. Cadby, secretary of the Wisconsin Utilities Association. His statement is based on the 1924 average state tax rate of 0.02065714. The rate for 1923 was 0.0279437.

**Year Book of the Brooklyn Edison Company.**—The Brooklyn Edison Company, which sold 445,000,000 kw.-hr. last year, paid bonuses of $224,000 to employees as their share in profits and transferred $963,000 to surplus, has issued a year book for 1923 of an extremely attractive nature. It contains two reproductions of etchings by Joseph Pennell, one showing the company's new office building and the other the new Hudson Avenue station during construction; a two-page reproduction of a mural painting of Brooklyn, showing the company's stations and substations, from the original in the directors' room, and a number of airplane views of the borough and other illustrations, as well as charts showing the capital structure, apportionment of expenses, growth in number of stockholders and similar facts.

**Electric Street Lighting May Be Extended at Boston.** — Announcing that engineers of the Edison Electric Illuminating Company of Boston are investigating at its request the cost of replacing gas street lamps with electric lighting, the Boston Finance Commission is urging the City Council to defer action on the proposed renewal of the Boston Consolidated Gas Company's contract until definite information can be had as to the feasibility of changing to electricity either in whole or in part in the territory now lighted by gas lamps. Sentiment on behalf of electric street lighting is developing as a result of the commission's earlier report to the Mayor and Council (ELECTRICAL WORLD, April 12, page 738), which maintained that if the prices named could be secured on an Edison contract, the city would save more than a million dollars during the next ten years.

**Plans of Pacific Power & Light Company.**—The Pacific Power & Light Company, which supplies public utility service to Pendleton, The Dalles, Hood River, Astoria and adjacent communities in Oregon and which also serves a rather extensive territory in the Yakima and Walla Walla districts in Washington, is actively engaged in investigating power possibilities on the Deschutes River, and it is probable that construction work on a large hydro-electric plant about 25 miles south of the mouth of the river will be begun in the summer or fall. A new steam - driven turbo - generator will double the capacity at the company's present plant on Young's Bay, Astoria. A new outdoor substation, modern in all details, is being erected at Pendleton and additional transforming equipment will be installed at The Dalles. Extensive reconstruction of suburban lines in the Hood River district has been provided for. It is anticipated that the company will spend in the neighborhood of $1,500,000 for improvements in 1924, as against $625,000 in 1923.

**Contract for Cushman Dam Let.**—Contract for construction of the storage dam, the first unit of the proposed Lake Cushman power project under development by the city of Tacoma, Wash., has been awarded to A. Guthrie & Company of Portland, Ore., on their bid of $886,148, which is $279,306 under the estimate of the chief engineer. The dam, as previously announced, will be built in the throat of the rock canyon of the North Fork of the Skokomish River. It will rise 235 ft. above the bed of the canyon, exclusive of the foundations below stream level, and will impound 450,000 acre-feet of water, creating a lake 10 miles long by about a mile wide. The first power unit will be installed a short distance below the dam, in the canyon bottom, utilizing the pressure of the water as it stands in the reservoir, which will produce 50,000 hp. Later a second use of the water will be made at sea level, to produce an ultimate 90,000 hp.

## Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations is published in the first issue of each volume. See January 5 issue, page 72, for latest list.]

Southwestern Division, N. E. L. A.—Hotel Grunewald, New Orleans, April 22-25. S. J. Ballinger, San Antonio, Tex.

Southwestern Public Service Association—New Orleans, April 22-25. E. N. Willis, Dallas, Tex.

American Welding Society—New York, April 23-25. M. M. Kelly, 29 West 39th St., New York.

American Electrochemical Society—Hotel Bellevue-Stratford, Philadelphia, April 24-26. Colin G. Fink, Columbia University, New York City.

American Physical Society—Washington, April 25-26.

Nebraska Section, N. E. L. A.—Omaha, May 8-9. H. M. Davis, Bankers' Life Bldg., Lincoln.

Pacific Coast Electrical Association—Hotel del Coronado, San Diego, Cal., May 17-20.

National Electric Light Association—Atlantic City, N. J., May 19-23. M. H. Aylesworth, 29 West 39th St., New York.

National Electrical Credit Association—Chicago, May 22-23. F. P. Vose, 1347 Marquette Bldg., Chicago.

American Society of Mechanical Engineers — Spring meeting, Cleveland, May 26-29. C. W. Rice, 29 West 39th St., New York.

Electric Power Club — Seaview Golf Club, Absecon, N. J., May 26-29. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Electrical Supply Jobbers' Association—Homestead Hotel, Hot Springs, Va., June 4-6. Franklin Overbagh, 411 South Clinton Street, Chicago.

American Association of Engineers—San Francisco, June 11-13. C. E. Drayer, 63 East Adams St., Chicago.

Canadian Electric Association—Ottawa, Ont., June 11-13. Louis Kon, 311 Power Bldg., Montreal.

North Central Division, N. E. L. A.—Winona, Minn., June 11-13. H. E. Young, Minneapolis General Electric Company, Minneapolis.

Pacific Coast Electrical Association—Hotel Coronado, Coronado, Cal., June 17-20. S. H. Taylor, 527 Rialto Bldg., San Francisco.

Georgia Electrical Association—East Lake Country Club, Atlanta, June 18-19. W. C. Drake, 75 Marietta St., Atlanta.

Empire State Gas and Electric Association—Commercial Section, Buffalo and Niagara Falls, June 19-20. C. H. B. Chapin, Grand Central Terminal, New York.

American Institute of Electrical Engineers — Annual convention, Edgewater Beach (Chicago), June 23-27. F. L. Hutchinson, 33 West 39th St., New York.

Associated Manufacturers of Electrical Supplies—Hotel Ambassador, Atlantic City, N. J., June 24-27. Frederic Nicholas, 30 East 42d St.

Society for the Promotion of Engineering Education—University of Colorado, Boulder, Col., June 25-26. F. L. Bishop, University of Pittsburgh, Pittsburgh.

**"Wisconsin - Minnesota Light & Power" to Be Dropped as Name.**—Steps have been taken by the Northern States Power Company to change the name of its largest division, the Wisconsin-Minnesota Light & Power Company, which it acquired last year, to the Northern States Power Company.

**Tugaloo Plant Completed.**—The last two units of the new Tugaloo power plant of the Georgia Railway & Power Company went into use last week, giving the company an addition to its generating capacity of 40,000 kw. The development involves a masonry dam 150 ft. high and approximately 1,000 ft. long, stretching from the Georgia to the South Carolina bank of the Tugaloo River, just below the junction of the Tallulah and Chattooga Rivers, and will utilize all the water passing through the Tallulah Falls plant in addition to the unregulated flow of the Chattooga River, which is approximately twice the size of the Tallulah. The plant operates under a head of 150 ft. With its completion the workmen have been transferred to the new Yonah development, several miles to the south, on the Tugaloo River, where the next power plant in the system is to be built. Active construction work was started the first of the year.

**The San Joaquin-Turlock Contract.**—The contract between the San Joaquin Light & Power Corporation and the Turlock Irrigation District already noted in these columns came before the California Railroad Commission for ratification this week on the application of the company. The Turlock Irrigation District and the Modesto Irrigation District are joint owners of the Dom Pedro storage reservoir and power plant with a capacity of 20,000 hp. The Turlock district owns a two-thirds interest and is distributing a portion of its share of the power over lines built by it. Under the present contract it will sell the surplus not called for by its own consumers to the San Joaquin Light & Power Corporation at a rate of 4.5 mills per kilowatt-hour, and the San Joaquin company is constructing a line for the delivery of this power. The contract calls for a maximum of 2,500 kw. from January to May inclusive and for a minimum of 6,500 kw. during the months from July to December inclusive. It is estimated that the power company will receive at least 35,000,000 kw.-hr. a year and that the district will secure a revenue somewhat in excess of $150,000 a year from water that has not been used in the past for the production of power.

**Rocky Mountain League Meets.**—A well-attended meeting of the Rocky Mountain Electrical Co-operative League was held in Salt Lake City on April 4 and was attended by delegations from several Intermountain states. Matters of interest to central-station companies, manufacturers, jobbers, dealers and contractors were discussed, and much emphasis was put on the need of conserving water power for future hydro-electric developments.

**A Pennsylvania Committee to Study Peak Load.**—Governor Pinchot of Pennsylvania is, it is said, to appoint a committee of five men to make a study of electrical load factors. These five men are to represent respectively the public, the laborers, the employers, the manufacturers and those advocating "giant" power plants. The object of the committee will be to work out a plan whereby the central-station peak may be reduced or made more nearly constant, with resulting savings in the price of electrical energy.

**Oil Burners 300 per Cent More Efficient than Hogged Fuel.**—At the steam generating plant of the Tacoma Light Department a final test of oil-burning equipment recently installed showed a capacity of slightly more than the 9,000 kw. rating of the generators. The oil-burning plant is the same as that installed in the power plants of the battle cruisers recently built in Tacoma and represents an investment of $50,000. The test showed that by installing the oil-burning equipment to replace the original hogged-fuel burners the two boilers in the plant, formerly rated at 4,000 hp., have been raised nearly 300 per cent in efficiency and can furnish steam for 12,000 hp.

**Power Possibilities of Three Rivers in Oregon.**—An investigation has recently been made by the United States Geological Survey to determine the possibility of developing power in the basins of Smith, Trask and Nestucca Rivers, which are within easy transmission distance of Portland, Ore. No exceptionally good power sites were found on any of these three streams. On the Trask River no reservoir sites were found, but by constructing seven low-diversion dams and 29 miles of conduit 23,000 hp. could be obtained for 50 per cent of the time and 4,900 hp. could be obtained for 90 per cent of the time. On Nestucca River at Meadow Lake there is a small reservoir site which, if developed for storage, would afford 9,100 hp. for 90 per cent of the time and 16,000 hp. for 50 per cent of the time at five sites. These projects would require three low-diversion dams and 26½ miles of conduit. But little potential power is available along Smith River. Storage could be provided, but it would be expensive. With a long dam 140 ft. high to afford storage 7,400 continuous horsepower could be obtained by constructing two small diversion dams and 34 miles of canal. The total potential power with regulated flow on Trask, Nestucca and Smith Rivers amounts to 21,600 hp. for 90 per cent of the time and 47,700 hp. for 50 per cent of the time.

# Men of the Industry

**Changes in Personnel**
**Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry**

## Arthur Williams Elected to Board of New York Edison Company

Arthur Williams, his many friends will be delighted to hear, has been elected a member of the board of directors of the New York Edison Company. This honor comes as a gracious recognition of Mr. Williams' long and meritorious work as general commercial manager in building up the business of the Edison company. That the board will gain by his advice and counsel may be taken for granted. If ever there was a man who knew the electrical business in all its ramifications, that man is Arthur Williams, and on

ARTHUR WILLIAMS

questions of public relations and business diplomacy the industry possesses few that are his equal. In public-spirited movements he has always taken a keen interest, if he did not actually assume leadership. Safety and welfare work have been next his heart for years, and in recognition of his efforts in this direction he has been decorated by the French and Spanish governments.

The electrical industry has heaped upon Mr. Williams its highest honors, both locally and nationally. He has been president of the National Electric Light Association, the Association of Edison Illuminating Companies, the New York Electrical Society, the American Museum of Safety, the Association of Corporation Schools and numerous other organizations. In business life Mr. Williams is a director of the Metropolitan Life Insurance Company, the Broadway Association, the Fifth Avenue Association, the Forty-second Street Property Owners' Association, the National Employment Exchange, the National Safety Council, the New York Association for the Blind and other organizations. Besides his connection with the New York Edison Company, Mr. Williams is vice-president of the Yonkers Electric Light & Power Company.

**Alcide E. Beauvais** has been elected president of the Montreal Tramways & Power Company, Montreal, succeeding William C. Finley, who recently resigned.

**H. C. Ray,** formerly assistant treasurer of the Knoxville (Tenn.) Power & Light Company, has been elected treasurer, succeeding C. J. Fleming, who resigned to engage in private business.

**E. L. Clark,** president of the Valentine-Clark Company and veteran cedar-pole producer, after traveling in Cuba and the Canal Zone recuperating from a breakdown last summer, left Havana April 7 and will be back in Minneapolis about May 1. Mr. Clark intends to spend some time at his Spokane yards on his homeward trip.

**Haylett O'Neil,** who has been connected with the Fuller Engineering Company of New York City, has become mechanical engineer in charge of construction and steam operations for the Arkansas Light & Power Company, Pine Bluff, Ark. Mr. O'Neil was formerly with Ford, Bacon & Davis, engineers, and recently spent several years in Europe, studying combustion.

**Charles A. Coffin,** one of the founders of the General Electric Company, was awarded a certificate of honorary membership in the Franklin Institute of Philadelphia on Wednesday, April 16. Mr. Coffin was president of the General Electric Company from its organization in 1892 until 1913, when he was made chairman of its board of directors, from which office he retired two years ago. The award was made in recognition of Mr. Coffin's achievements in and contributions to the electrical industry. It is the thirtieth honorary membership to be granted in this scientific society.

**F. M. Cockrell,** formerly promotion manager of the McGraw-Hill Company, Inc., and more recently manager of the industrial department of the Campbell-Ewald Company, advertising agency, has joined the staff of the Society for Electrical Development. Mr. Cockrell is a graduate electrical engineer and was at one time Chicago publicity manager of the Westinghouse Electric & Manufacturing Company. He will supervise the program for the development of more adequate wiring and will bring to this important branch of the activities of the society long experience and specialized training.

**Edward Y. Rice,** chief of the standardization laboratory of the Hartford (Conn.) Electric Light Company, has recently been appointed assistant superintendent of the lighting department. Mr. Rice, who is a graduate of the Rensselaer Polytechnic Institute, taught for three years in its department of electrical engineering and physics before entering the employ of the Hartford company in 1914. Since that time

he has served in various capacities, including those of purchasing agent, illuminating engineer and engineer in charge of special work. Mr. Rice will retain personal supervision of the testing laboratory.

**J. Leon Terry,** formerly connected with the Jasper (Ala.) office of the Alabama Power Company, has been transferred to Nauvoo in the capacity of local manager.

**S. J. Spurgeon,** formerly connected with the Utica (N. Y.) Gas & Electric Company, has entered the operating department of the Alabama Power Company.

**Raymond S. Reed,** power-plant advisory engineer with the Solvay Process Company, Syracuse, N. Y., is now in the mechanical division of Stone & Webster, Inc., Boston.

**George S. Jones, Jr.,** power sales engineer of the Georgia Railway & Power Company, Atlanta, left the company on April 15 to become the commercial manager of the Texas Power & Light Company, Dallas, Tex.

**Garnet Wilder,** who has been with the Hartwell (Ga.) office of the Georgia Railway & Power Company for several years, has been advanced to the position of superintendent of the Cornelia district with headquarters at Cornelia.

**John K. Swanson,** district manager of the Consumers' Power Company at Jackson, Mich., has been made manager of the Saginaw district, succeeding John A. Cleveland, recently transferred to Grand Rapids.

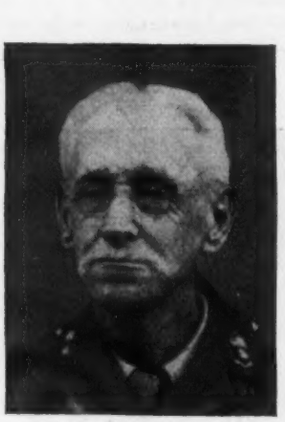
**John E. Mangan,** formerly superintendent of the railway department of the Rutland (Vt.) Railway, Light & Power Company, is now identified with the Reading (Pa.) Transit & Light Company. Both these properties are under the management of the W. S. Barstow Company.

**F. L. Williamson,** sales manager in the New York district of the Economy Fuse & Manufacturing Company for the past eight years, has resigned to become general sales manager for the Taplet Manufacturing Company of Philadelphia. Mr. Williamson's headquarters will be in the company's general sales office in New York.

**Willis C. Lincoln,** who has been manager of sales and engineering for the National Railway Appliance Company, New York, has resigned to become Western sales manager of the Electric Service Supplies Company, with headquarters in Chicago. Mr. Lincoln entered the regular test course of the General Electric Company after studying electrical engineering at Union College. Soon he was transferred to the consulting engineering department of the company, later becoming identified with its railway engineering department. Mr. Lincoln, who put himself through college with money earned as a piano salesman, has a preference for sales work, and when the opportunity presented itself he accepted an appointment in the General Electric's sales department, where he spent several years. Subsequently he joined the engineering department of the Railway Improvement Company of New York before affiliating himself with the National Railway Appliance Company.

## Col. Rookes E. B. Crompton, British Engineer

Col. Rookes E. B. Crompton, British engineer, has long been prominently identified with two branches of engineering—road transport and electrical engineering. Born at Sion Hill in 1845 and educated at Elstree School and Harrow, he entered the royal navy and subsequently, after receiving several army appointments in India, he was selected to carry out the first experiment on a considerable scale of road transport by steam power. In 1876 he returned to England and one year later became engineer-in-chief of the Stanton Ironworks Company, using for the first time electric light for illuminating the foundries at night. At that time he began the manufacture of electric light and power apparatus, and his firm, Crompton & Company, by 1886 had become the largest manufacturer of electrical apparatus in England. From 1886 to 1887 he was engaged in designing and carrying out the first electric power station at Vienna and the station in London at Kensington Court, the Kensington & Knightsbridge Electric Lighting Company then founded being the oldest of the supply companies in England. He is still chairman of that organization. In 1898 Colonel Crompton was invited by the British government to form a corps of electrical engineers to deal with the problems of electric light, power distribution and field telephones for the army, and in 1899, after being reinstated in the army, he was sent out to South Africa in command of the new electrical corps. When later he left Crompton & Company he was made the first engineer to the newly appointed Road Board, and since then he has been actively engaged on road-transport problems. Colonel Crompton was elected president of the Institution of Electrical Engineers in 1896 and last year received the distinction of being made an honorary member.



COL. R. E. B. CROMPTON

**Frank J. Jones,** formerly engineer of way and structures with the Knoxville (Tenn.) Power & Light Company, has been appointed chief engineer.

**A. K. MacNaughton** has been appointed superintendent of distribution of the Pawtucket (R. I.) division of the Blackstone Valley Gas & Electric Company.

**E. Nielsen,** structural designer, has joined the electrical construction department staff of the British Columbia Electric Railway Company, Ltd., Vancouver, B. C.

**Lloyd S. Purcell,** who has been assistant secretary and assistant treasurer of the Dubuque (Iowa) Electric Company since last summer, has recently in addition assumed the duties of assistant treasurer of the Eastern Iowa Electric Company, both properties being operated by the Albert Emanuel Company, Inc., New York. Mr. Purcell had been assistant treasurer of the Leavenworth (Kan.) Light, Heat & Power Company for a number of years when it was taken over in 1922 by the Albert Emanuel Company and made a unit of the Kansas Electric Power Company. At that time he was made assistant treasurer of the new organization, remaining in that capacity until his transfer to Dubuque.

# Obituary

**Charles Sumner Wirt,** electrical inventor and early associate of Thomas A. Edison, died on Sunday, April 13, at his home in Philadelphia. After leaving school he joined the Menlo Park (N. J.) organization, subsequently leaving to enter the electrical manufacturing business for himself. Mr. Wirt was sixty-six years of age.

**Dr. Wilhelm Schmidt,** whose pioneer work in steam superheating led to the development of the most widely used types of locomotive superheaters, has died at Bethel near Bielefeldt, Germany. Dr. Schmidt's best-known accomplishment was the creation of a practical locomotive superheater, but he also did much toward practical superheating in power plants and on steamships. He was sixty-three years of age.

**George F. Wood,** who was connected with the Nordberg Manufacturing Company, builder of Diesel power generating units, for many years as erecting engineer, died at his home on April 5 of heart disease. Mr. Wood, who was a pioneer in this field of electricity, was born in Cincinnati and went to Milwaukee about twenty-five years ago, being connected with the Nordberg company until blindness forced him to retire three years ago.

**John S. Simpson,** auditor of the Washington Water Power Company, Spokane, Wash., died suddenly on April 5 as a result of apoplexy. Mr. Simpson was a native of Greenland, N. H., and after spending several year with the Thomson-Houston Company and its successor, the General Electric Company, he went to Tacoma to enter the employ of Stone & Webster. Subsequently he became the chief accounting officer of the Washington Public Service Commission, where he remained until 1918, when he took the position he held at the time of his death. Mr. Simpson was fifty-three years of age.

# Commission Rulings

**Discriminatory and Unlawful Rebates.**—Approving for the time being the rates of the Houghton County Electric Light Company, although criticising the fixed charge for managerial services made by Stone & Webster on the ground that it is not easy to determine its justice since the dividing line between the efforts of the Boston office and the efforts of the local organization at Houghton does not exactly coincide with the dividing line that would be established were the administration entirely local, the Michigan Public Utilities Commission declared against refunds to wholesale power users such as requested by the Quincy Mining Company under the guise of "excess recovery." "The rates charged such companies during the period in question," said the commission, "were rates properly approved by the commission and were therefore legal rates. The fact that the Quincy Mining Company originally asked for other rates, or that if certain things had been done or left undone the size of the Quincy or other power bills would have been affected, does not alter the fact that they were charged the legal rates the same as all other customers To allow the Quincy Mining Company or any other company rebates or excess recoveries would be to violate the law which prohibits discrimination and rebates."

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**"Off-Peak" and "On-Peak" Rural Lighting Service.**—For the purpose of determining active demand on farms, the Wisconsin Railroad Commission, in the course of a decision affecting electric rates of the Wisconsin Gas & Electric Company, divided farm buildings into two classes—those where the lighting would come on the peak and those where the lighting would be off-peak or incidental. The commission said: "In determining the active load of the residence three bedrooms and various other minor parts of the house are exempt because the energy used for lighting same is assumed to be used 'off-peak.' Likewise, we believe that the lights may be installed in open sheds for sheltering live stock or machinery. Those installed in farm garages and other miscellaneous buildings will, for the most part, either be off-peak or used so seldom as to have no noticeable effect in the determination of peak load. On the other hand, the lights used in the stables housing the dairy cattle or the workhorses will be used 'on-peak.' Also, if the modern theory of lighting poultry houses to increase egg production is followed, the lights used in the main poultry house would be used 'on-peak.' We conclude, then, that the main barns used as horse stables and dairy stables, and the poultry house, when wired, are 'on-peak' business and should be counted as active rooms. In the event that the horse and cow barn is one building there is but one active room. If separate buildings are used, two active rooms should be counted. All other wired buildings we consider off-peak, and they should be exempted when making the count of active rooms. Barns that are not wired should not be counted, except that where no outbuildings on the farm are wired one active room should be added to the count of active rooms in the residence. We take this position for the reason that the rates offered to the rural consumers by the company are exceptionally liberal, and for the reason that on most farms where the outbuildings are not wired a large lamp may be installed in the yard and relied upon to illuminate the outbuildings partially."

# Recent Court Decisions

**Legislature May Impose Other Duties on Body Set Up by Constitution than Those Imposed by That Instrument.**—The City of Denison, Tex., bringing action against the Municipal Gas Company to prohibit it from collecting a service charge, assailed the authority of the Railroad Commission, on the ground that it was a body set up by the constitution to regulate railroads and that therefore the Legislature had no power to impose upon it duties affecting other utilities, and also on the ground that the Legislature had deprived the courts of constitutional powers and conferred them on a non-judicial body. The Court of Civil Appeals of Texas decided against the city on both points, holding that a constitution is a limitation rather than a grant of power and that state legislatures do not receive from it the power and authority they exercise in the realm of law enforcement, and that the powers conferred by the Legislature on the commission are not judicial in character. (257 S. W. 616.)*

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**Oklahoma Supreme Court Scores State Commission for Dilatory Methods.**—In denying temporarily an application for a writ of supersedeas made in McAlester Gas & Coke Company vs. Oklahoma Corporation Commission the Supreme Court of Oklahoma took occasion to denounce the deliberate methods followed by the commission, to which the company first applied for increased rates in October, 1921, hearings not being completed until February, 1922, and judgment not entered until January, 1924. The Supreme Court said that where proceedings were properly instituted "the Corporation Commission, upon assuming jurisdiction over the cause, is required by law to proceed with a hearing on said case and to make a final determination of the issues, and in so doing it must not, without the consent or fault of the utility, permit unnecessary, unreasonable, unjust or unjustifiable delay. If it permit such delay in the conduct of the proceedings or in making its final determination of the issues, this court, in a proper case and upon its jurisdiction being lawfully invoked and upon just, clear and convincing proof, will by a proper writ of supervisory control compel the Corporation Commission to proceed and make its final determination of the issues involved within a proper and reasonable time." Commenting on certain provisions of the state law, the court proceeds: "Can it be the law that the Supreme Court under the mandate of the constitution and the statutes must consider a case like this on appeal with a rapid and speedy determination, subject only to the rights involved in habeas corpus, and at the same time be the law that the Corporation Commission, before the case reaches us on appeal, can delay the progress of a hearing or the determination of its judgment after the case has been submitted for a period of years? The question contains its own answer."

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

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**Federal Court's Findings in Colorado Power Company Case.**—In the finding of the United States District Court of Colorado doubling the valuation of the Colorado Power Company's property made by the Public Utilities Commission of the state (Colorado Power Company vs. Holderman et al.; see ELECTRICAL WORLD, January 12, page 106) these among other decisions were made by the court: (1) The making of a just return for the use of the property of a public utility involves the recognition of its fair value, if it be more than its cost, and the value of the property is to be determined as of the time when the inquiry is made regarding the rates. (2) Where the company's plant at Shoshone produced a variable amount of electrical energy, because the plant had no dam and used the direct flow of the river, the company was entitled to have included as a necessary part of its system for rate valuation purposes its plant at Boulder, which, because of having a reservoir, could be used not only to supplement the plant at Shoshone at times of low water, but also in case of breakdowns of plant or transmission lines. (3) Certain small and inefficient plants of the company, operated occasionally as reserve plants, were not proper to be included in the company's system for valuation purposes. (4) It was not proper to exclude the load of three wholesale consumers, consuming 60 per cent of the company's total production of electricity, in determining what were the used and useful parts of the company's system. (5) An inventory of the company's system, while not purporting to show the present-day fair value thereof, was competent and valuable evidence of such value for rate purposes. (6) A valuation claimed for marketing of securities was not a proper item. (7) The company was not a public utility as to wholesale customers which used power under special contracts to operate street cars and to retail it for light and power, as their contracts did not necessarily affect the general public. (8) Where a rate is fixed by a binding contract a public utility cannot complain, and the question of whether the rate is too low to give a reasonable return is immaterial. (295 Fed. 178.)

# Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

## Trend in Industrial Electric Heating

### Accumulated Experience and Growth of Standards Have Brought the Industry to the Time for More Active Selling

By Wirt S. Scott
Westinghouse Electric & Manufacturing Company, East Pittsburgh

THE advance of civilization may be said to depend very greatly upon the art of heating. In spite of this, the development of heating has not kept pace with other arts. Until within the past seven or eight years fuel, labor and materials were cheap. Inefficiency in operation was tolerated, since the resulting losses were of secondary importance. Efficiency in ovens and furnaces was practically an unknown quality owing to the low fuel costs. Ovens and furnaces were designed and built by the user without any knowledge of what to expect in the way of heat losses. Manufacturers could afford to pay for labor to watch the ovens or furnaces, to handle rejected or spoiled materials, or to carry or truck materials around, in and out of the ovens or furnaces by hand. Materials were so cheap that in case they were improperly heat-treated they could be treated again or perhaps entirely discarded without a great loss.

The time, however, has come when fuel, regardless of its character, can no longer be wastefully used, as in the past, and industrial plants are becoming educated to the use of better construction in ovens and furnaces. This condition makes it increasingly easy to sell electric heating apparatus, which, owing to the fact that the fundamental cost is high, must be designed and built to conserve energy, necessitating a more expensive construction.

#### High Cost Forcing the Art

The high price of labor demands that each manufacturing plant employ the minimum amount of labor to maintain a given production. By means of electric heat and automatic temperature control, supplemented where permissible by conveyors, the labor required for a given production can be reduced materially over that required by other forms of heating. The increased cost of materials makes it essential that there not only be no rejects, but that materials relatively low in cost be so fabricated that when completed they will be sufficiently improved in quality to take the place of a higher grade of raw material formerly used.

On the top of all this there is the inevitable ultimate demand for a uniform high-grade product. There is even now a demand for quality instead of quantity where weight is a detriment or does not add any desirable characteristics, and where reduced weight would be of decided advantage provided a smaller cross-section having the same tensile strength could be used. The use of electric heat permits of the conservation of energy, the saving of labor and the production of a high-grade, uniform product in a manner unattainable by any other form of heating.

#### Background Experience

The age of industrial electric heating in this country can be said to be about eight years. The development has been along substantially the same lines as that of any other field through the production of a large number of specialized pieces of apparatus to meet the varied conditions of application. There was no precedent to show the logical trend of development, and the only way knowledge could be gained was by having the actual experience of success or failure; hence it was inevitable that a large number of different kinds of apparatus and different applications would be made which at that time should not have been developed.

Through years of experience and the success or failure of installations trained men have accumulated vast funds of information sufficient to enable them to predict in advance whether or not an application can be classified as desirable or undesirable. With this knowledge and purpose of mind, they are in a position to render a great service in promoting industrial electric heating by reducing to a minimum the number of unsuccessful applications and by creating confidence on the part of the user that these men have sufficient experience to determine accurately whether or not it is a paying investment for him to electrify.

#### The Era of Standards

In the development of any new business the reasons for failures are oftentimes as important as the reasons for success. Thus it has been necessary for those electrical manufacturing companies that are interested in industrial heating in a broad way to keep closely in touch with installations. This has resulted in the development of a line of apparatus which will meet a large percentage of the applications and the accumulation of sufficient operating data to enable one to determine accurately the operating costs and the net results to be accomplished.

There are two periods in the development of any large field where a considerable amount of money must be expended in the development of apparatus. The first is in the early stages when there are no standards. Each application is more or less special, and a sufficient amount of apparatus has not been developed to meet the majority of the needs. The second stage is after the art has been perfected to a high degree and the only development needed comes in the way of new invention, requiring new methods for accomplishing the same purpose. Industrial electric heating is in the intermediate class. At the present time there is a sufficient amount of equipment developed to meet the majority of applications, and if we are to make a success of this business, we shall have to stop developing apparatus and sell more standard equipment.

The inexperienced engineers' or salesmen's attention is much more

easily gained by a very special piece of apparatus operating in some extraordinary manner and accomplishing some phenomenal results. This is far more exciting or interesting than heating glue in a glue pot. However, both the electrical manufacturing company and the central-station company must live and must market their product at a reasonable cost.

### TIME FOR SELLING

The electrical manufacturers and the central stations are co-operating in the promotion of industrial electric heating, and the business must be mutually profitable. A reasonable amount of development work can be expected of the electrical manufacturing company, and a reasonable amount of investigation work can be expected of the central station. However, such a program cannot be carried out indefinitely with a business as broad in scope as that of industrial electric heating. The question to be decided is, When will the central stations and the electrical manufacturing companies cease developing and start selling?

It can be done today because standardized apparatus meets with less sales resistance and consequently is far easier to sell. Also there is such apparatus now available which will adequately cover at least 50 per cent of all of the applications of industrial electric heating, and in connection with practically all of these applications enough data have been accumulated to justify such applications.

Undoubtedly industrial electric heating is going to make rapid strides within the next five-year period for two reasons—first, because of the standardization of apparatus and the applying of this apparatus to definite applications which have proved economical in the past; second, because of the educating of central-station engineers by means of a central-station school supplemented by data now being collected and tabulated by the industrial heating committee of the National Electric Light Association.

## Capitalizing on Salesmen's Visits

**A Personal Experience That Carries a Message to Executives—Ten Years' Delay in Buying Money-Saving Equipment**

BY C. C. SCOTT*

DURING a recent conversation with the president of one of our large Western manufacturing companies he asked: "What objectionable thing stands out in your mind, now that you are selling?" To this I replied: "The general lack of interest that the executive manifests in a salesman's visit to his plant. He should assure himself that the salesman is to have an opportunity to tell his story to those who should be interested in the product or service he has to sell, but he does not." By way of explanation, I said: "Consider your own plant. Can you recall a piece of electrical equipment which you have purchased recently and which has effected an appreciable saving in your plant?" After a few moments of reflection he mentioned a particular piece of equipment which he said would save thousands of dollars yearly, his estimate being based on its saving over its first six months of use. I than asked if he could recall when it was first placed on the market. He could not, but, being familiar with the device, I told him that it was at least ten years ago. The question then arose why he had not bought it years before.

This executive did not know it had existed so long, although he could now recall that the salesman who finally sold it to him had been calling at his plant for more than ten years. Did he know who in his plant besides the purchasing agent was interviewing salesmen? He knew he wasn't himself and admitted that he could not really say who was.

His company obviously had lost ten times several thousands of dollars, for it could have used this equipment just as well ten years ago as at present. It had suffered this loss just because some one in his plant who could analyze the merits of the product had not listened to the salesman's story years before.

At the end of our talk this president told me that as soon as he returned to his plant he would call a conference of his officials, department heads and the purchasing agent and issue an order never to be broken that no salesman was to leave his plant without first having an interview with the person or persons who should be interested in his story. If the salesman sold electrical goods, he was to see the electrical engineer; if metal-working machinery, the master mechanic; if chemicals, the chemical engineer, and so on.

Several months after this interview I called at this plant and presented myself, without any reference to my acquaintance with the president, and was interviewed by the purchasing agent. When he learned that I represented a manufacturer of electrical equipment he directed me to the electrical engineer. The latter was interested in my product and its possibilities in the plant and therefore took me for a conference with the works manager. We "sold" the works manager, and finally we went to the president to get financial approval of the purchase, and I got the order.

The president said that he valued very highly his former conversation with me and that his company had profited from it several times because of its present method of receiving salesmen. He asked me as a favor to others like himself and to my fellow salesmen to relate this story whenever and wherever possible. And so I have written this for the readers of the ELECTRICAL WORLD.

*Mr. Scott was formerly a central-station engineer and is now a salesman in the electrical industry.

## Washington Forced to Think of Industry Statistics

IT HAS become so important to the coal industry to have reliable statistics if disaster is to be avoided during the period of intensive competition which is certain to result from the three-year agreement entered into with the United Mine Workers that principal attention at this time seems to be focused on the question of the legality of trade statistics. Steps are being taken to secure the enactment of legislation which will make clear the rights of industry to have the information necessary to the intelligent conduct of business.

It has been suggested that the Department of Justice should bring a test case against an association engaged in clear-cut statistical activities. The department is understood to be disinclined to take such action, although it is believed to concede that these statistics are in the public

interest. It also has been suggested that a friendly suit be brought against one of the local associations by a consumer of coal who could contend that he is being injured by the statistical activities of the association.

It is believed by many in Washington that some way can be found to secure from the administration a definite statement of policy in connection with trade statistics. One of the coal trade associations might be able to secure a pronouncement of administration policy were it to make a very definite offer to the Department of Commerce to furnish it with its full statistical reports. The offer would be accompanied by a specific statement that it did not expect any guarantee of immunity from prosecution. The right would be conceded to the Department of Commerce to check against the original returns the accuracy of any reports furnished by individual companies and to prescribe the time and method under which the information should reach its members. It would seem that such an offer would have to be definitely accepted or rejected by the department.

Considering Secretary Hoover's sympathy with the need for industry statistics, it is not improbable that he would be willing to carry such a specific offer to the next Cabinet meeting and try to get an expression of administration policy. It is hard to see how the administration could decline to accept such an offer. The discussion of it by the Cabinet, it is felt, might result in the initiation of a test suit by the Department of Justice, which is the step most desired.

# Business Conditions

**A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand**

THE general tone of the electrical business continues this week a little better than for the month past. Industrial buying seems to have improved somewhat, noticeably in New England and in the Southeast. Purchasing by central stations continues to be the strongest element in the market, although the volume of power-company business has slackened somewhat within the last few weeks.

General sentiment seems to be growing that the uncertainty of the situation in the national capital will have a serious effect upon the building outlook, the belief being that the slowing down of industrial operations throughout the country will inevitably cause a decrease in industrial building, which will in turn incline the home builder to caution. Such a condition would probably continue until after the presidential election. In spite of this, however, so great is the need for central-station expansion and so strong will be this influence in the market that manufacturers are confidently expecting a better business than in 1923. It is a fair statement that there is no pessimism in the industry at this time.

There was noticeable activity in range sales in New England this week following a successful cooking and range show held in Boston. Jobbers are buying conservatively and the market is steady and strong. The demand has slowed down somewhat in supply lines in the New York district and the general volume of business is considered good. Power company buying in the Southeast is reported quite active, and there is strong demand for construction material, while appliance campaigns are being pushed in a number of cities and the general outlook is bright. High-tension sales have been excellent in the Middle West, and the demand for appliances is active. Radio has just begun to feel the slackening which precedes the approach of summer and made its appearance in the East two weeks ago. Building is again reported brisk on the Pacific Coast and is stimulating the market for wiring materials. Power-company purchasing there is active.

## Electrical Industries Consume Half the Copper in United States

A TOTAL of 800,000,000 lb. of copper was consumed by the electrical industries of the United States during the year 1923 according to a survey made by the Copper and Brass Research Association. This is approximately one-half of all the copper consumed in the United States last year. Radio has contributed largely to the consumption of copper, a radio set requiring on an average 5 lb. of the metal. A further growth in copper consumption in these industries is indicated by the expected increase in the use of electricity and electrical equipment as obtained from a survey made by the ELECTRICAL WORLD.* The yearly consumption of copper is expected to be in excess of a billion pounds in the near future.

The business of mining and refining copper is a basic industry most important to electrical manufacturers, and year by year the growth of the one industry has been paralleled by the growth of the other. Central-station expansion activities, going forward today at such a rapid rate, form a fairly accurate index of the increase in the demand for copper in the electrical industries.

*See issue of January 5, 1924, page 17.

## Transformer Demand Good—Prices Stable

THE demand for power transformers is gradually improving, with high-voltage transformers slow at the present time and for distribution transformers steady, according to various manufacturers. The increasing use of power transformers is due partly to the large number of manufacturing plants relying wholly on electric power and to the fact that utility companies are selling electricity at primary rates so that customers are purchasing their own transformers.

The development of interconnection programs is leading to the sale of substantial capacities in large power transformers, although in manufacturing circles the opinion is advanced that the potential market for equipment for this type of service is somewhat exaggerated. However, there should be an increase in demand to serve outlying districts never before reached by electric power, with a tendency toward higher-voltage units on account of the high potentials at which interconnecting systems are usually operated.

At the present time prices seem to be fairly stable and very little over 1913, although labor and most materials are higher. This condition is due largely to decreased production costs, which were reflected in the slight reduction in prices announced a few months ago. Supplies of insulating material, steel and copper are excellent, general conditions in the transformer industry are good, and manufacturers are having no particular difficulty in meeting present demands. Slight delays, however, have been caused at times by inability to get porcelain. But, taking the industry as a whole, considerable spare manufacturing capacity now exists. A gradual improvement in the quality of labor used in transformer manufacture has been observed in recent years, wages are at present steady and the supply of labor is plentiful.

Stocks of distribution transformers are good, with deliveries on the most popular ratings being made from stock, while, generally speaking, deliveries on power transformers are somewhat behind the trade requirements. Power-transformer deliveries seem to vary widely among manufacturers, and a number of orders are placed on short notice so that the industry has been endeavoring to reduce the actual delivery time. Foreign business is quiet owing to the exchange situation, there being considerable competition from British and also Swedish manufacturers, although in some fields there is a decided preference for American design.

## Good British Market for Electrical Heating Pads

AMERICAN manufacturers of electrical merchandise have not yet realized the possibilities of the British market for electrical heating pads, according to the Consul General's office, London. They are to be found only in

the large department stores, while many small dealers have never even heard of them.

Few English houses have central heating plants, so that the bedrooms are left to the mercy of the climate. It is, therefore, customary in the majority of English households to put hot-water bottles in the bed each night of the winter. Some of the bottles are of rubber and others are stone in the form of jugs. The electric bed warmer is far more satisfactory than the bottle and would be used to a larger extent if the price were not so high. A French electric warmer is being sold in one of the large department stores and it is reported that the sales are good. It sells for approximately $9.30. A German warmer can be had for about $4.60, but the sales have not been good. If the American manufacturers could put a pad on the market at a price not higher than those of the makes now selling, it could be sold if aided by a little advertising.

## Used-Machinery Market Is Improving—Stocks Good

A GREATLY increased activity and a good volume of business in used machinery are reported by various dealers. Although there was an active demand in 1923, the latter quarter of the year showed a decided falling off in business with a consequent softening in prices. With the increased activity generally reported this year, however, prices have stiffened much more quickly than was expected, due largely to the absence of surplus stocks in the hands of dealers. Nevertheless, prices are still lower than they have been for some time and are believed to be more nearly at their true and conservative level.

Another factor which has operated to improve the used-machinery market has been the reduction of large stocks of war materials which have now been absorbed to such an extent that their influence as a factor in price reduction no longer exists. In short, economic conditions following the war have forced dealers to depend upon a large volume of business at a small margin in order to obtain any profits. No longer can the used-machinery business be conducted on a large profit per sale, a fact fully recognized by nearly all the dealers. Where machinery has been purchased advantageously, however, and is resold on a reasonable profit basis, rather than on the so-called intrinsic-worth standard, business is very good. Dealers, and they are comparatively few, who are trying to get fancy prices for stock purchased at comparatively high figures are no longer active in the market.

The demand for larger generators and larger motors is reported very good in New England at the present time. Woolen mills, paper mills and miscellaneous industries in the interior of New England are buying alternating-current generators freely in ratings of 100 kw. to 600 kw., while the reciprocating-engine and small-steam-turbine market is also showing life. A large volume of business is being transacted within industrial isolated plants. Motor-generator sets, rotary converters, belted alternating-current and direct-current generators and alternating-current motors are in best demand in the New York territory, there being practically little or no demand for direct-current equipment, particularly of the 115-volt class. Small motors for wood-working machinery, tool making and machine-shop work are the most staple and are among the best sellers.

In the Middle West territory there is a good market for all sizes, ratings and speeds of various types of both alternating-current and direct-current motors and transformers. Most of this business is obtained from extensions among industrials, including mills, automobile factories and small power users.

Stocks are reported as being large enough to provide for most requirements, and dealers are able to serve the needs of the industry well. Most of the liquidation of electrical machinery, both new and used, has been accepted and written off, so that prices are on a firm plane and considered equitable, and there is no present evidence of any price changes in prospect unless the new motor market should show marked change in price or demand. On the whole, if economic conditions do not change during 1924, a good increase in business is expected as most dealers have taken the wise stand of being very careful in their purchases and junking such apparatus as is not thoroughly fitted for resale.

## The Metal Market

LITTLE activity has developed in the non-ferrous metal market during the past week. Buying has been confined chiefly to immediate needs, as the feeling still exists that prices are more likely to decline than to advance. In the case of copper, however, any decrease in consumption is quite likely to be offset by a decrease in production. The ruling price is now 13¼ cents, with fairly good sales being made at that figure, while concessions on this price have been made in one or two cases, thus reducing the average price slightly. The lead market continues to decline, virtually all inquiries being for small tonnages. More buying can hardly be expected until the price becomes better stabilized.

NEW YORK METAL MARKET PRICES

| | April 9, 1924 Cents per Pound | April 16, 1924 Cents per Pound |
|---|---|---|
| Copper, electrolytic | 13⅛ | 13.475 |
| Lead, Am. S. & R. price | 8 | 8⅛ |
| Antimony | 10⅛ | 9 |
| Nickel, ingot | 27 | 27 |
| Zinc, spot | 6.55 | 6.40 |
| Tin, straits | 50⅛ | 49⅛ |
| Aluminum, 98 to 99 per cent | 27–28 | 27–28 |

## New England Industrial Buying Shows Better Tone

ORDERS for electrical material for textile establishments have picked up perceptibly within the past few days, although these are generally of small size. Plant improvement and repair is being pushed in many places, although there is reasonable expectation of continued conservative buying from these sources. The building industry, central stations and domestic appliance field are showing healthy activity, and there is a very fair sale of heavier electrical apparatus on a scale somewhat under last year's early spring figures. One of the bright spots of the weekly report is a quickened interest in electric ranges which has already found an outlet in increased retail sales following the remarkably successful electric cooking school and range show held last week in Boston and attended by more than ten thousand persons. A vigorous advertising campaign has been launched to push this class of sales to the limit. Washers, flat-irons and cleaners are moving rapidly, and portable lamps are selling well.

Jobbers' stocks are being kept close to current requirements and deliveries are in excellent shape, broadly speaking. Prices have stiffened slightly on pole-line hardware, and rigid conduit is firmer on some local quotations, though no new factory card is out. Minor readjustments are in process on sockets, flexible armored conductor and outlet boxes.

## Building Construction Again Active on Pacific Coast

POWER-company buying on the Pacific Coast this week has been very good, especially for poles, crossarms and pins. Sales of electric ranges are only fair. The fact that range business is widespread in the Far West has made it inevitable that the demand suffer from conditions which have adversely affected virtually all of California except the larger Coast cities. Farm-plant business is poor for the same reason, but it is expected to be stimulated by the arrival of shipments, now en route, of certain smaller and cheaper sets.

Building construction, after a fortnight's appreciable lull, is again very brisk and a good volume of business in conduit, boxes and other building supply lines is reported, although in noticeably smaller quantities per order. Sockets, switches and other schedule material sales also show a good turnover with conservative buying very evident. Jobbers' stocks are excellent and have been well maintained through the spring without serious shortage. Many railroad bids are reported for iron wire, lead cable and signaling apparatus.

## Business Quiet in New York—Volume Considered Good

BUSINESS in the New York district has presented no outstanding features during the past week, but the present volume is considered good and an optimistic feeling prevails. Although the industrials are not buying actively, there is a good market for smaller apparatus. Central-station business has slowed down somewhat, there being evidence of a conservative spirit in the buying from this quarter. Deliveries are still slow on oil circuit breakers and switchboards because of unfilled orders. Prospects for railway business for the next two or three months are considered good as a number of nego-

tiations now active are expected to develop.

There has been a distinct slowing up in supply lines according to the jobbers. Lamp business so far this month has shown a decided drop, due entirely to a slacking off of purchases by industrials, as the dealers' lamp business has improved. Owing to the falling off in radio, salesmen are now able to push other lines with some degree of success. Very good demand is being maintained for blowers and exhaust fans springing from national advertising campaigns and aggressive sales work. There is as yet no definite evidence of increased spring buying, about which there seems to be a general feeling of uncertainty.

### Industrial Building Active in Southeast District

CONSTRUCTION continues in a healthy volume in the Southeast district. Building permits in Atlanta for March were $250,000 in excess of February, though something under the figure for March, 1922. There is a slowing up in residential construction, which is reflected in residential lighting-fixture orders, but the demand for commercial fixtures continues strong. Requests have been made for bids on several large expansion jobs.

Southeastern power companies are placing orders for high-tension transformers in capacities from 150 kw. to 2,000 kw., but shipments are reported of from eighteen to thirty weeks on most sizes. Very satisfactory sales of heating devices and hollow ware are reported by jobbers, most of this going to central stations which have entered aggressively into the merchandising field. Several of the larger central stations have under way small appliance campaigns, with plans for washing-machine, range and vacuum-cleaner sales to be started during the next sixty days. More or less inclement weather has slowed up electrical retail business, but the outlook continues bright.

There is considerable activity in industrial lines in the Birmingham district, the steel mills being on a satisfactory operating basis, with one of the larger steel corporations undertaking the construction of a new open-hearth furnace that will cost approximately $8,000,000. This mill will be electrically driven. The Birmingham Railway, Light & Power Company is preparing soon to re-enter the merchandising field after being out of the market for several years.

### Building Continues Brisk in Middle West

BUYING in the Chicago district is still largely confined to secondary equipment for utility companies. Motors and industrial control-equipment sales have been good, although they can be classed only as normal. High-tension equipment sales, such as high-potential fuses, cut-outs, etc., have been excellent. The demand for pole-line hardware and insulators continues, but not quite so actively as last week. Appliance sales have been remarkably good, with washing machines considerably in the lead, one manufacturer reporting a single order for more than five hundred machines. The demand for lighting equipment has increased somewhat, due, no doubt, to the active campaign recently closed in that field. Industrial heating sales are keeping up to the high standard set the first quarter of the year.

Building activity continues brisk, with the demand active for most commodities. One prominent manufacturer of code wire is offering No. 18 green and yellow lamp cord at a price considerably below the present market in an effort to move an overstock on this size. Otherwise prices on code wire remain stable. Radio sales have declined a trifle, although not noticeably so. The shortage of tubes, which now includes the dry-cell amplifiers, is acute and seriously retards radio sales. However, the trade is optimistic, as this situation should soon rectify itself.

## Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

### Allis-Chalmers Earnings Show Good Increase

The Allis-Chalmers Manufacturing Company in a report for the year ended December 31, 1923, shows net profits, after expenses and reserves for taxes have been deducted, of $2,703,636, compared with $2,208,549 in 1922. Sales billed during 1923 amounted to $25,612,708, as against $20,794,045 the previous year. Current assets are shown as $29,423,593 and current liabilities $4,818,768. Unfilled orders on hand at the end of last year totaled $12,000,131, compared with $8,215,545 at the end of 1922.

President Falk in his report further points out that during the year important developments have been made in the company's products, particularly in the case of steam turbine and hydro-electric units, where larger machines with increased capacities are in demand. For instance, a 65,000-kva. Allis-Chalmers hydro-electric unit is to be installed in the plant of the Niagara Falls Power Company and is the largest complete unit of this type built by any single manufacturer. The company has also completed the redesign of its entire line of general purpose motors and starters.

### Prices Reduced on Hisey Electric Tools

The Hisey-Wolf Machine Company, Cincinnati, announces that increased production has made it possible to reduce the price of many of its electric tools, and a new price list, No. 29, has been issued, effective since March 17. Electric drills of the most popular sizes have been reduced by from 12½ per cent to 17 per cent, and many other reductions of from 5 per cent to 10 per cent have been made.

### Bristol Company Establishes Repair Plant at Chicago

The Bristol Company, Waterbury, Conn., manufacturer of recording instruments and distributor of radio equipment, has leased 2,740 sq.ft. in the Larkin Building, 3617 South Ashland Avenue, Chicago, in order adequately to take care of the Middle West business, which has grown to large volume. Most of this area will be devoted to repairing and recalibrating Bristol instruments sold and used in the Chicago territory, but some will be used for stocking made-up instruments for quick deliveries and various lines of radio merchandise. The present salesroom and offices of the Bristol Company will be maintained in the Monadnock Building.

### U. S. Ball Bearing Company Changes Name

The U. S. Ball Bearing Manufacturing Company, 4527 Palmer Street, Chicago, announces a change in its name to the Strom Ball Bearing Manufacturing Company. The bearings manufactured by the company have always been known as Strom ball bearings so that now the product and the company will have the same name. No changes have been made in the company personnel, and the same principles which have governed the company's business in the past will continue.

### General Electric Orders Decrease

Orders received by the General Electric Company for the three months ended March 31 totaled $73,487,903, Gerard Swope, president, announced this week. This is approximately 10 per cent better than the figure estimated three weeks ago. It is a decrease of 8 per cent over the first quarter of 1923, when orders totaled $80,010,045, but compares more favorably with $74,452,442 for the final three months of 1923.

### Westinghouse Sharon Plant Extensions Under Way

The new buildings and additions to the Sharon (Pa.) plant of the Westinghouse Electric & Manufacturing Company are now under construction. They will be one-story structures, fireproof and of reinforced concrete and steel and will afford an additional floor space of about 6 acres to be devoted chiefly to the manufacture of transformers with a capacity greater than 500 kva. The largest building will contain about 157,000 sq.ft. of floor space and will be of very heavy construction, having crane lifts of about 55 ft. with cranes of 75-ton capacity. The present works cover approximately 7

acres and are devoted entirely to the manufacture of transformers of 500 kva. capacity and less. The additions will allow the company to carry out its long-contemplated expansion in the transformer field and will form a self-contained unit for the manufacture of transformers of all sizes.

With the exception of the steel framework, which is being erected by the American Bridge Company, Stone & Webster, Inc., have charge of the building operating under the plans and specifications. The buildings will be ready for occupancy about November 1.

## Jewell Electrical Instrument Company Expanding Facilities

Owing to the increased demand for measuring instruments caused by central-station expansion and radio developments, the Jewell Electrical Instrument Company, Chicago, will take possession about May 1 of the two upper floors of the building it owns and is now partly occupying. When this new factory addition was constructed four years ago the company leased the second and third floors, but, according to Orval Simpson, president, the increase in volume of business has necessitated the use of the complete building for the proper conduct of its business. This change will practically double the floor space now occupied and with the additional facilities which the entire building affords will mean a speeding up of production through re-routing manufacturing processes in the factory.

## General Electric Receives Order for Muscle Shoals

Four 32,500-kva. (80 per cent power factor), 100-r.p.m., 1,200-volt, three-phase, 60-cycle vertical waterwheel generators have been ordered from the General Electric Company by the federal government, for the power house under construction at Muscle Shoals, Ala. Switchboard and auxiliary equipment is also included in the order. The switchboard equipment will include control apparatus for eight generating units, four of which have previously been ordered. The Muscle Shoals development, when all the equipment is in service, will be the largest hydro-electric station in the United States.

## Radio Corporation to Supply Freed-Eisemann with Tubes

Arrangements have been completed whereby the Radio Corporation of America, which controls the patents for manufacture of "Radiotron" vacuum tubes, will supply the Freed-Eisemann Radio Corporation, an independent radio manufacturing concern, with a sufficient number of vacuum tubes for use with their receivers. Inasmuch as the vacuum-tube shortage has been considered as the weakest link in the present system of merchandising radio receivers, this agreement is considered of great importance.

**The Western Electric Company** has leased for a term of years a new seven-story building, 158 ft. x 500 ft., to be erected at Allegheny Avenue, Clearfield, Ormes and B Streets, Philadelphia, by the Allegheny Avenue Realty Company. The factory is estimated to cost approximately $900,000, and the rental totals $1,750,000 for the term of the lease. The lessee plans to remove its present works at Eleventh and York Streets to the new location as soon as the building is completed, with the installation of considerable additional equipment for increased production.

**The Iron City Engineering Company,** Pittsburgh, engineer and contractor, announces the removal of its offices from the Frick Building annex to 410 Union Trust Building.

**The Simplex Electric Heating Company,** 85 Sidney Street, Boston, announces the development of a new plug for appliances which is being made up with a 6-ft. cord.

**The General Electric Company** has just leased quarters in the new Union-Davenport Trust & Savings Bank Building, Davenport, Iowa, for the establishment of Davenport offices. Temporary quarters have been obtained in the Putnam building pending completion of the new building.

**Harvey Hubbell, Inc.,** Bridgeport, Conn., announces a new line of receptacles for metal signs, ceiling fixtures and outlet boxes, also a new pull chain extender for kitchen units.

**Thoner & Martens,** Boston, manufacturers of heavy-duty and high-voltage switches, announce the appointment of C. W. Baxter, 1328 Broadway, New York City, as Eastern representative and Leslie W. Miller, 417 South Dearborn Street, Chicago, as Western representative.

**The Edison Electric Appliance Company,** Chicago, announces the manufacture of a new electric cooking unit known as the "C6." It is designed for use in place of one of the surface units of the new Hotpoint range and may also be applied to the Hotpoint Hughes and to certain of the old General Electric ranges.

**The Delta-Star Electric Company,** 2433 Fulton Street, Chicago, has completed plans and will soon award a general contract for the construction of a new one-story addition, to cost approximately $27,000.

**The H. T. Electric Company,** 612 North Capitol Avenue, Indianapolis, manufacturer of electrical apparatus, will begin the immediate construction of a new one-story addition to its plant, to cost close to $38,000, for which a general contract has already been awarded.

**H. M. Haven & A. T. Hopkins, Inc.,** Boston, engineers and architects, announce their removal from 40 Court Street to new and larger quarters at 11 Beacon Street.

**The American Insulator Corporation,** New Freedom, Pa., manufacturer of cold-molded insulation for electrical wiring devices, has opened an office in Chicago at 213 South Peoria Street to cover the Western territory. W. R. McCoy, formerly with the Arrow Electric Company, is in charge of the Chicago office.

**The Quigley Furnace Specialties Company's** Chicago office will be moved to larger quarters on May 1 at 9 South Clinton Street.

**The Pennsylvania Electric Repair Company,** Pittsburgh, has since April 12 been in new quarters at 129 First Avenue.

**The Superior Electric Products Company,** 4449 Easton Avenue, St. Louis, manufacturer of household appliances, has taken a long-term lease of the third floor of 2206 Pine Street, which it expects to occupy about May 1. This change has become necessary because of the rapid growth of the business.

**The Killark Electric Manufacturing Company,** St. Louis, announces the appointment of H. W. Stransbury & Company, Inc., Audubon Building, New Orleans, as sales agents for Louisiana, Mississippi and Alabama.

**The Motor Repair & Manufacturing Company,** 6715 Hamilton Avenue, Cleveland, has awarded a contract for the erection of a two-story brick addition to its present plant, estimated to cost $40,000.

**The Pure Carbon Company,** Wellsville, N. Y., announces the establishment of a Columbus (Ohio) office, the Engineering Merchandising Syndicate, 600 Joyce Realty building. This office will render personal engineering service on all brush problems and requirements in its territory.

**The Charles J. Bogue Electric Company,** 513 West Twenty-ninth Street, New York, manufacturer of electrical apparatus, has leased a floor in the factory at 132 King Street for plant extensions.

**Walter T. Wells** has resigned his position as general sales manager of the King Manufacturing Company, Chicago, to return to Denver, where he will engage in developing some private undertakings.

**The Electric Power Equipment Company,** Philadelphia, has absorbed the Bennett Electro Service Company, Marietta, Ga., manufacturer of lightning arresters. G. N. Lemon, formerly general manager of the Bennett Electro Service Company, is now connected with the Southern States Electric Company in Birmingham.

**The Allen-Bradley Company,** Milwaukee, announces the appointment of M. H. Hallenbeck, formerly sales engineer for the Westinghouse & Electric Manufacturing Company at Boston, as district manager for the New England territory. Mr. Hallenbeck's office is in the Compton Building, Boston.

**The Ajax Electrothermic Corporation,** Trenton, N. J., recently sold to the United States Navy Department the largest high-frequency induction furnaces yet constructed. One furnace is capable of melting 200 lb. of steel, one of melting 500 lb. of brass or copper, and four smaller furnaces provided with electrical equipment rated at 140 kva. The frequency used in these furnaces is of the order of 15,000 to 20,000 cycles per second.

**The Hazard Manufacturing Company,** Wilkes-Barre, Pa., announces that after May 1 the Chicago office will be located at 32 South Clinton Street.

## New Trade Literature

CONCRETE LAMP STANDARDS.—The Western Electric Company, 195 Broadway, New York City, is distributing twelve leaflets describing and illustrating various types of concrete lamp standards manufactured by the Chicago Concrete Post Company, Lawrence, Lamon and Leland Avenues, Chicago.

SLOTTER AND UNDERCUTTER.—The Martindale Electric Company, 11,723 Detroit Avenue, Cleveland, is distributing a bulletin covering its "Aurand" commutator slotter, the "Imperial" undercutter and other products of the company.

AUTOMATIC CONTROL.—The Empire Control, Ltd., Glasgow, Scotland, is distributing a booklet describing the "Empire" automatic pump control for docks, railways, sewage systems, etc.

ELECTRIC BRAZING MACHINES.—W. D. Crumpton & Company, 8-10 Bridge Street, New York City, have issued a pamphlet describing the "Thornton" electric brazing machines.

SALES HELPS.—"Electrical Gifts for the Bride" is the title of manual No. 103 issued by the Society for Electrical Development, Inc., 522 Fifth Avenue, New York City, which is one of a series of reference books, all of them designed to assist the industry to promote the idea of "do it electrically."

COAL HANDLING AND CONVEYING MACHINERY.—The Gifford-Wood Company, Hudson, N. Y., is distributing a folder calling attention to the "G-W" products, including coal-handling, elevating and conveying machinery, wagon loaders, etc.

INDUSTRIAL POWER PLANTS.—Lockwood, Greene & Company, engineers, 24 Federal Street, Boston, are distributing a forty-page booklet in which they describe and illustrate various industrial power plants installed by the company. The book is designed for the use of men in charge of industrial plants and power plants and discusses some phases of the design of industrial power plants as distinguished from the design of central power plants.

STREET-LIGHTING EQUIPMENT.—The Holophane Glass Company, 342 Madison Avenue, New York City, has issued bulletin No. 357, covering its "2-Way" and "4-Way" Holophane refractors for street lighting. This bulletin gives a general description of their construction and performance and economic reasons for use of these refractors.

## Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Rangoon, India (No. 9,877), for electrical goods.

Purchase is desired in Durango, Mexico (No. 9,831), of electric light plant and batteries for farms.

Purchase is desired in Horta, Azores (No. 9,829), of electric motors.

Purchase is desired in Saltillao, Mexico (No. 9,827), of electric motors, 10 hp., 220 volts, alternating current, 60 cycles, three-phase, and electric elevators.

Purchase and agency is desired in Dublin, Ireland (No. 9,832), for radio apparatus, cabinet and open, two, three and four tubes.

Purchase and agency is desired in Riga, Latvia (No. 9,830), for radio apparatus and parts.

An agency is desired in Rome, Italy (No. 9,835), for transmitting and receiving radio apparatus.

An exclusive agency is desired in Amsterdam, Netherlands (No. 9,800), for radio sets.

An agency is desired in Medellin, Colombia (No. 9,834), for radio sets.

An agency is desired in Dublin, Ireland (No. 9,833), for cabinet and open, two, three and four-tube radio sets.

Purchase is desired in Durango, Mexico (No. 9818), of complete producer gas engines.

Purchase and agency is desired in Rio Janeiro, Brazil (No. 9,823), for refrigeration machinery and apparatus.

An agency is desired in Milan, Italy (No. 9,861), for copper tubes, copper-wire insulators and other specialties.

AUTOMATIC SWITCHBOARDS FOR SYDNEY, AUSTRALIA.—Tenders will be received by the Postmaster General's Department, Sydney, Australia, until July 22 for automatic switchboards (Schedule V. 41). Tender forms and full particulars may be obtained from the supply officer, Australia House, Strand, W.C.2, London, England.

## New Incorporations

THE PIEDMONT POWER CORPORATION, Chatham, Va., has been chartered with a capital stock of $50,000 for the purpose of distributing electricity in Pittsylvania and Campbell Counties. The incorporators are: John I. Livers, Charlottesville, president; R. C. Hunt, Chatham, secretary; E. H. Lane, Alvista; Malcolm K. Harris, Dansville, and others.

THE CRISP POWER COMPANY, Tarboro, Route 2, N. C., has been incorporated with a capital stock of $20,000 by W. W. Eagles, E. M. Lovelace and others.

# Construction News

**Projects, Plans, Bids and Contracts, Contemplated or Under Way**

## New England States

FRANKLIN, N. H.—Arrangements have been made by the Franklin Light & Power plant for extensions to its plant on Memorial Street, including the installation of new generators and waterwheel, increasing the capacity by about 500 hp.

MANCHESTER, N. H.—The Manchester Traction, Light & Power Company plans extensions in its hydro-electric generating plants at Garvin's Falls, Merrimack River, and at Kelly's Falls, Piscataquog River, to include the installation of additional water turbines and generator units, etc. Stone & Webster, Inc., 141 Milk Street, Boston, are engineers.

BOSTON, MASS.—The Edison Electric Illuminating Company has filed plans for the erection of a substation at 9 Grenville Terrace, to cost $67,000. The company will also build a substation on Head Place, to cost $65,000, with adjoining structure for machine rooms to cost $135,000.

BROCKTON, MASS.—Plans have been filed by the Brockton Edison Electric Illuminating Company for its proposed new plant to be erected at Dupont Circle, which is to be the terminal of the 115,000-volt lines, and which will eventually be connected with the new plant at Somerset. Stone & Webster, Inc., 147 Milk Street, Boston, are contractors and engineers.

SPRINGFIELD, MASS.—Extensions and improvements contemplated by the United Electric Light Company during 1924 include 7 miles of 13,200-volt cable line, with 2 miles of duct for same; one 6,000-kva. transformer bank, one 1,000-kva. transformer bank, two street-lighting circuits, automatic equipment for one hydro station, part automatic equipment for one substation, 2 miles of sixteen-duct and twenty-four-duct line for feeders. L. J. Scott is manager.

NEWPORT, R. I.—Bids will be asked at once by the local supply officer, Navy Department, for conductor cable, copper wire, fittings, etc. (Y. & D. Req. 31.)

## Middle Atlantic States

ADAMS BASIN, N. Y. — The Adams Basin Electric Light & Power Company contemplates extending its transmission line from Pine Hill to Parma. J. J. Gunther is treasurer.

ALBANY, N. Y. — The Municipal Gas Company contemplates building a substation and extending its transmission line to Selkirk. Carl H. Graf is vice-president.

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company contemplates extending its transmission line to Sanitora Springs, to cost about $25,000.

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until April 22 for rotary converters, flue-gas temperature recorders, etc., for the navy supply depot, South Brooklyn.

BUFFALO, N. Y. — Business men and residents of the Schiller Park section have petitioned the City Council to erect fifty luminous arc lamps in Genessee Street between Warring Avenue and the city line.

BUFFALO, N. Y.—Extensions and improvements contemplated and under way for this year, involving an expenditure of about $3,000,000, have been announced by the Buffalo General Electric Company. The work includes two new substations for the distribution system in addition to a number of changes in existing equipment. Other improvements include the laying of two new underground high-tension lines—one from the terminal station across the city to Kerr and East Ferry Street, and the other running underground from the Lower Terrace to East Market Street. The new cables will carry 22,000 volts.

FLEISCHMANN'S, N. Y.—The Fleischmann's Light, Heat & Power Company contemplates the erection of a 44,000-volt transmission line through Pine Hill to a point near Shandaken, tapping the 33,000-volt transmission line from Kingston to Stamford.

GRANVILLE, N. Y.—The Granville Electric & Gas Company has been granted permission to extend its lines into Granville Township (about 6 miles), to furnish electrical service.

KINGSTON, N. Y.—The Public Service Commission has authorized the Kingston Light & Power Company to erect a 7-mile transmission line through the towns of Olive and Hurley to the hamlets of Ashokan and Shokan. The cost of the extension is estimated at about $15,000.

OSWEGO, N. Y. — Surveys are being made by the Battle Island Company, it is reported, for the construction of a hydro-electric plant at the east end of dam No. 16 on the Oswego River.

PINE HILL, N. Y.—The Pine Hill Electric Company contemplates the erection of a 44,000-volt transmission line tapping the 33,000-volt line from Kingston to Shandaken.

PORT EDWARD, N. Y.—Plans are being prepared by the Standard Paper Company for a power plant to cost about $100,000.

SARANAC LAKE, N. Y. — The Paul Smith's Power, Light & Railway Company contemplates a hydro-electric development on the Racquette River at Racquette Falls, to cost about $350,000. The work will consist of a dam, power house, 3,000-ft. steel penstock and generating equipment.

WATERTOWN, N. Y.—Surveys, it is reported, have been made by the International Paper Company along the Black River at several mill sites for hydro-electric power developments.

PITTSTOWN, N. J.—The New Jersey Power & Light Company contemplates extending its transmission line to Pittstown and Quakertown, for which right of way is being obtained.

GREENVILLE, PA.—The Mercer County Heat, Light & Power Company contemplates the installation of additional equipment at its plant.

KUTZTOWN, PA.—At a special election to be held April 22 the proposal to issue $20,000 in bonds for the purchase of the local power plant of the Fleetwood & Kutztown Electric Light, Heat & Power Company, to be owned and operated by the municipality, will be submitted to the voters. If taken over, extensions and improvements are planned.

MILLERSBURG, PA.—F. M. Waring, Tyrone, and associates have been granted a preliminary permit by the Federal Power Commission for the construction of a hydro-electric plant on the Susquehanna River, near here, to cost about $500,000.

PEACH BOTTOM, PA. — The Susquehanna Water & Power Company, recently organized to take over and consolidate the Susquehanna Water Power Company, the Peach Bottom Township Water Power Company, Fulton Township Water Power Company, Martic Township Water Power Company and the Lower Chanceford Water Power Company, contemplates the construction of a hydro-electric power plant on the Susquehanna River, to cost about $450,000.

PHILADELPHIA, PA.—Bids will be received by the United States Marine Corps until April 30 for 50,000 ft. cotton-covered lamp cord. (Schedule 442.)

PHILADELPHIA, PA. — The Viscose Company, Marcus Hook, plans to build a power house at its proposed artificial silk mill to be erected at Tacony and Shelmire Streets, to cost about $500,000.

PITTSBURGH, PA. — The Philadelphia Company has acquired the former local plant of the American Locomotive Company, which will be remodeled for a storage and distributing plant for equipment for its various utility interests.

WILMINGTON, DEL.—The Street and Sewer Department has been authorized to call for bids at once for the installation of an improved street-lighting system on Market Street. The plans call for 2,000-cp. luminous-arc lamps.

ST. MICHAELS, MD. — The Michaels Utilities Commission contemplates the installation of a Fairbanks-Morse oil-engine generating unit for emergency service. E. W. Milliken is general manager.

RIDGELEY, W. VA.—The Titan Cement Company, recently organized, plans to build a power house at its proposed cement mill at Ackerman, near Ridgeley, to cost about $300,000.

WARWOOD, W. VA, — The Wheeling Electric Company has secured a site in Warwood on which it proposes to erect a substation for furnishing power to the city water plant.

WASHINGTON, D. C.—Extensions and improvements contemplated for 1924 by the Potomac Electric Power Company include the installation of one 20,000-kva., 13,200-volt, 60-cycle turbine generator, installation of six 13,200-volt, 60-cycle underground cables and one 13,200-volt, 60-cycle overhead line, and rebuilding of one 15,000-kva., 6,600-volt, 25-cycle turbine generator. L. E. Sinclair is general superintendent.

## North Central States

ADRIAN, MICH.—The installation of an ornamental lighting system in the business section is under consideration. It is proposed to utilize the surplus current from the waterworks plant to maintain the lamps.

GAINES, MICH.—The Gaines Lighting Company contemplates the installation of one 25-hp. oil engine and a 25-kw. generator with necessary distribution lines, etc. M. L. Spencer is manager.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until April 25 for economizer intake hoppers for the division of light and power.

TOLEDO, OHIO. — The Toledo-Edison Company is considering appropriating about $2,500,000 for expansions during the present year, to include an addition to the local generating plant, transmission lines, etc.

VINE GROVE, KY.—The Kentucky Utilities Company, Louisville, has acquired the local electric plant owned by C. R. Wyatt. The company will tap its transmission line from Camp Knox to Elizabethtown to furnish electricity here.

ALBION, IND.—The Water and Light Department contemplates the construction of a coal-storage building and the installation of a few ornamental lamp standards. Edwin M. Malony is superintendent.

FLAT ROCK, IND.—Plans are being considered by C. E. Newton, Shelbyville, for the installation of a steam power plant at the local canning plant.

FORT WAYNE, IND. — The Indiana Service Corporation contemplates the installation of two 1,200-hp. boilers during 1924. William S. Richhart is electrical engineer.

MENTONE, IND.—The Interstate Public Service Company is said to be perfecting plans for extensions and improvements in the local system recently acquired by the company.

POSEYVILLE, IND.—The Consumers' Power Company has secured permission to purchase the property of the Poseyville Light & Power Company. Plans are under consideration for extensions in the transmission line in this section.

MANSFIELD, ILL. — The Mansfield Electric Company contemplates the installation of a new distribution system. F. L. Longstreth is secretary.

RIVERTON, ILL.—Extensions are contemplated to the municipal electric plant, including the installation of three transformers and extending distribution lines. Vinson Saville is village electrician.

WAUKEGAN, ILL. — New construction work planned by the Public Service Company of Northern Illinois for 1924 includes the following: Schedule A—A new outdoor automatic substation at Libertyville and a transmission line to connect the Zion City substation with the new Waukegan generating station. Additional equipment will be installed at Waukegan, Lake Bluff and North Chicago in order to meet the capacity of the feeders. About 1,800 new meters, it is estimated, will be required in the district to care for new business. Schedule C includes a new substation at the site of the present Church Street substation in Evanston to transform energy received from the Waukegan generating station at 132,000 volts to distributing voltages, and also an increase in the capacity of the Clark Street substation at Evanston, the construction of a 12,000-volt line from it to the Church Street substation and the installation of an automatic substation at Desplaines.

LAKE GENEVA, WIS.—The Southern Wisconsin Electric Company contemplates the erection of 5 miles of 26,400-volt circuits to Lake Geneva and Delaware for standby use. G. B. Burdick is purchasing agent.

MERRILL, WIS.—The City Water Works Company is considering replacing the present steam-driven pumping machinery with electrically operated pumps.

MOUNT STERLING, WIS.—The Interstate Power Company plans to erect a high-tension transmission line from McGregor, Iowa, to Mount Sterling to supply electrical service here.

POLONIA, WIS.—The Wisconsin Valley Electric Company, Wausau, plans to erect a transmission line from Jordon to Polonia, about 5 miles.

OWATONNA, MINN.—Bids will be asked by the City Council about May 1 for the construction of a proposed municipal electric plant to cost about $350,000. Arthur L. Mullergren, Kansas City, Mo., is engineer.

THIEF RIVER FALLS, MINN. — Bids will be received by the city of Thief River Falls until May 6 for one oil engine and direct-current, 250-volt generator. Bids desired on both 300-hp. and 500-hp. units. For details see Searchlight Section.

ATLANTIC, IOWA. — The Municipal Light and Water Department has purchased a 1,000-kva. Allis-Chalmers turbine for the electric plant, to be installed in July. T. E. Nichols is manager.

EAGLE GROVE, IOWA.—The Northern Iowa Gas & Electric Company, plans extension to its local plant, including the installation of new equipment.

ROCK RAPIDS, IOWA.—The installation of a new engine and generator in the municipal electric light plant is under consideration. W. F. Gingrich is superintendent.

SIOUX CITY, IOWA.—The City Council has approved the installation of an ornamental lighting system on streets in the vicinity of Cecilia Park. L. N. Hintgen is city engineer.

BERNIE, MO.—The Union Electric Light & Power Company plans to erect a transmission line from Dexter to Bernie.

ODESSA, MO.—The installation of an ornamental lighting system on Main Street, in the business section, is under consideration.

GRAND FORKS, N. D.—Bonds to the amount of $110,000 have been authorized by the voters for the installation of a municipal electric light plant.

BRIDGEPORT, NEB. — The Western Public Service Company is planning to remodel its local generating plant, recently acquired, for emergency service and the erection of additional transmission lines.

MULLEN, NEB.—Plans are under way for the installation of a municipal electric lighting system.

## Southern States

WINSTON-SALEM, N. C.—The Southern Public Utilities Company contemplates the construction of a 1,000-kva. substation at White and Thirteenth Streets.

SPINDALE, N. C.—The Town Council plans extensions and improvements in the municipal lighting system, to cost about $18,000.

WEST POINT, GA. — The West Point Manufacturing Company contemplates the installation of a new generator and replacing a waterwheel in its Longdale hydro-electric plant this year. W. Lea Clark is chief engineer.

CALLAHAN, FLA.—Plans are under consideration to change the system of the municipal electric plant from direct to alternating current during the year. Charles P. Decker is chief engineer.

SARASOTA, FLA.—Bids will be received by E. J. Bacon, Mayor, until April 28, for equipment for a municipal electric plant, including one 750-hp. Diesel oil engine directly-connected to a 500-kw. generator, with belt-driven exciter, switchboard and accessory apparatus; also, alternate bids for one 500-kw. generator with uniflow or turbine steam engine, with exciter and control panels; two surface condensers; two water-tube boilers and auxiliary equipment.

TAMPA, FLA. — The Tampa Electric Company plans to erect a transmission line to Mango, with extension to Dover and vicinity. A substation will be installed for commercial service.

BIRMINGHAM, ALA.—The C. H. Grayson Lumber Company plans to build a power house in connection with its proposed mill, to cost about $150,000.

NATCHEZ, MISS.—The Southern Railway & Light Company is reported to be taking bids for a power house, to cost about $45,000.

BATESVILLE, ARK. — The Board of Commissioners contemplates the installation of two Fairbanks-Morse type Y oil engines (100 hp. each) in the municipal plant this year. E. H. Glenn is superintendent.

MARSHALL, ARK.—The Marshall Light Company plans to put the street lamps on an independent circuit and to establish a day service. Thomas Matlock is owner.

MOUNTAIN HOME, ARK.—The Mountain Home Electric Company plans to install a larger engine this year. W. H. Wolf is owner and manager.

NEW ORLEANS, LA.—The Ford Motor Company, Detroit, it is reported, plans extensions in the power house at its local assembling works in connection with proposed additions, to cost about $500,000.

OAK GROVE, LA. — Plans have been authorized by the City Council for the installation of a municipal electric power plant. Henry A. Mentz, Magnolia, Miss., is engineer.

CLARENDON, TEX.—The Texas Central Power Company plans to erect a transmission line to Memphis, with substation, to cost about $150,000.

DALLAS, TEX.—The Hollywood Company, American Exchange Bank Building, recently incorporated, plans to install a street-lighting system on a tract of 150 acres near the city, to be developed for residential purposes, at a cost of about $400,000. J. M. Preston, Central State Bank Building, is engineer.

## Pacific and Mountain States

NEW DUNGENES, WASH.—Bids will be received by the Bureau of Yards & Docks, Navy Department, Washington, D. C., until May 7, for the construction of a power plant here. (Specification 4938.)

RITZVILLE, WASH.—The Washington Water Power Company, Spokane, plans extensions in its transmission system in this section, including the erection of a line to the Tapton district.

SEATTLE, WASH.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until April 29, for two turbo-generators and one set of spare parts. (Schedule 2063.)

ANAHEIM, CAL. — Improvements contemplated this year to the municipal electric light plant include building a new outdoor sunstation and the installation of three (750-kva., each) transformers to replace three transformers of 1,200 kva. V. W. Hannum is superintendent.

LOS ANGELES, CAL.—The City Council is considering the installation of ornamental lamps on a portion of Central Avenue. The plans call for 205 standards.

LOS ANGELES, CAL.—Extensions contemplated by the Los Angeles Gas & Electric Corporation for 1924 include one 23,457-hp. turbo-generator, together with necessary cooling tower and condenser capacity; two additional Stirling boilers, 10,000-kva. in transformers, five additional substations, high-tension lines, conduits and distribution equipment. In addition to the above, work has started on the first unit (40,200 hp.) of the new Seal Beach steam generating plant, which will have an ultimate capacity of 288,000 hp. E. Houghton is comptroller.

MANTECA, CAL.—The Pacific Gas & Electric Company has authorized extensions in its transmission line in the South San Joaquin irrigation district.

OAKLAND, CAL.—The Pacific Gas & Electric Company plans to build a substation at Fifty-first Street and Shattuck Avenue, to cost about $50,000.

PINE KNOT, CAL.—The Bear Valley Utility Company will complete a three-circuit telephone line from Pine Knot to San Bernardino and a local exchange. It will also erect 12 miles of distribution lines around Bear Lake for lighting and power service. Within the next month it will begin work on a domestic water system to care for 30,000 people. B. T. Ergenbright is general manager.

SANTA BARBARA, CAL. — The construction of a municipal hydro-electric plant on Lake Gibraltar, the initial installation to cost about $40,000, has been recommended by Herbert Nunn, city manager.

SUISUN, CAL.—Bonds to the amount of $11,000 have been voted, for the installation of an ornamental lighting system in the business district.

VOLTA, CAL.—The Pacific Gas & Electric Company has appropriated $77,000 for the rebuilding of its local power station.

YOSEMITE, CAL. — The United States National Park Service contemplates connecting with the system of the San Joaquin Light & Power Company during 1924 at Cascades for an exchange of power. The transmission line to El Portal will carry 33,000 volts. J. W. Emmert is electrical engineer.

CLIFTON, ARIZ.—Application has been made to the Federal Power Commission by Dell M. Potter, Clifton, and associates for permission to build a hydro-electric plant on the Black River, to cost about $500,000, including transmission system.

SAFFORD, ARIZ.—J. A. Haralson, owner of the local electric plant, expects to extend the transmission lines immediately to Thatcher, a distance of 3 miles.

CUT BANK, MONT. — The Cut Bank Electric Light & Power Company contemplates extensions to its plant, including the installation of a 50-kw., three-phase, 2,300-volt oil-engine-driven generating unit, together with automatic control of hydro-electric installation. Frank H. Seal is president and manager.

## Canada

MAGRATH, ALTA.—The Crane-Cassidy Electric Company is considering replacing its steam engine with a 50-hp. semi-Diesel engine and may possibly purchase another 25-hp. semi-Diesel oil engine direct-connected to a three-phase alternator. M. J. Crane is president and manager.

VANCOUVER, B. C.—The British Columbia Electric Railway Company has begun work on the power house of the Alouette Lake power development. The cost of the project is estimated at $2,300,000 and will include a small railway, power house, dam and a 3,600-ft. tunnel between Alouette and Stave Lakes. Tenders, it is understood, will soon be asked for the construction of the tunnel.

ST. JOHN, N. B.—The New Brunswick Electric Power Commission has been authorized to prepare full plans and specifications for the development of Grand Falls, on the St. John River, near the Maine harbor. It will be some time before work can be undertaken on the proposed plant, as it will be necessary to secure permission from the International Joint Commission to build on international waters and from the Quebec government to build dams on lakes in that province tributary to the St. John River.

INVERNESS, N. S.—The Inverness Railways & Coal Company contemplates the installation of a larger generator, 2,300 volts, three-phase, 60 cycles, establishing a twenty-four-hour service, rearrangement of lighting system and tripling the lighting load during 1924. J. P. Messervey is resident engineer.

ALMONTE, ONT. — Bids will soon be asked by the Town Council for construction of a new dam and electric light plant, to cost about $30,000. C. Barber & Son, Meadford, are engineers.

CONISTON, ONT. — The Lorne Power Company, Ltd., has purchased a 2,500-hp. waterwheel and an 1,875-kva. generator, which it will soon install at its Nain Falls plant. W. H. Soule is electrical engineer.

NORVAL, ONT. — The Hydro-Electric Power Commission of Ontario is considering the erection of a transmission line from Georgetown to Norval.

YORK TOWNSHIP, ONT.—The Township Council has passed a resolution requesting the Hydro-Electric Power Commission of Ontario to approve of the issue of the township debentures to the amount of $200,000 for the extension of the Hydro lines in the township and for other purposes.

# Electrical Patents

**Announced by U. S. Patent Office**

**(Issued March 25, 1924)**

1,487,998. ELECTRODE; M. Woolf, San Francisco, Cal. App. filed Dec. 26, 1922. For the application of electric current to the body.

1,488,003. TELEGRAPHIC TRANSMITTER; E. Ehrhardt, Hermsdorf, near Berlin, Germany. App. filed Nov. 2, 1920. In which the different signals given at non-uniform speed are accumulated, to be subsequently sent over the line in the same succession but at uniform speed.

1,488,006. RADIO TRANSMISSION SYSTEM; R. A. Heising, East Orange, N. J. App. filed Sept. 29, 1919. In which two-way communication may be attained at each station over a single antenna.

1,488,078. ATTACHING MEANS FOR ELECTRICAL FIXTURES; B. A. Vandy, Rochester, N. Y. App. filed June 14, 1921. For securing outlet boxes to the walls and ceilings of old buildings.

1,488,114. RADIO TELEGRAPHY AND TELEPHONY; J. H. Hammond, Jr., Gloucester, Mass. App. filed Aug. 24, 1912. Systems and methods for periodically varying the amplitude or frequency or both of transmitted electric waves.

1,488,167. SIGNALING SYSTEM; R. G. Ramsdell, Brooklyn, N. Y. App. filed Jan. 30, 1920. For notifying telephone user if receiver is left off hook.

1,488,175. CONNECTOR; J. G. A. Strandell, Chicago, Ill. App. filed Oct. 30, 1920. To fasten wire, cable or conduit to terminal boxes and provide watertight joint.

1,488,207. SIGNALING SYSTEM; G. W. Kuhn and R. G. Ramsdell, Brooklyn, N. Y. App. filed Jan. 30, 1920. For notifying telephone user if receiver is left off hook.

1,488,234. ELECTRICALLY DRIVEN SEWING MACHINE; F. Diehl and M. Hemleb, Elizabeth, N. J. App. filed Sept. 3, 1921.

1,488,275. ELECTROMAGNET; N. E. Norstrom, Chicago, Ill. App. filed Aug. 23, 1920. Used in the construction of vibratory apparatus.

1,488,310. ELECTRIC APPARATUS; C. A. Birch-Field, Larchmont, N. Y. App. filed Sept. 26, 1922. For the reception of impulses at radio frequencies and conversion into impulses at audio frequencies.

1,488,337. ELECTRIC VALVE; H. Gernsback, New York, N. Y. App. filed May 14, 1921. Commonly known as audion tube.

1,488,347. CLAMP FOR ELECTRICAL CONDUCTORS; T. F. Johnson, Jr., Atlanta, Ga. App. filed July 6, 1921. For heavy duty, avoiding the use of springs.

**(Issued April 1, 1924)**

15,807 (reissue). SPEED-REGULATING SYSTEM FOR ELECTRIC MOTORS; W. T. Holmes, Baltimore, Md. App. filed Aug. 29, 1922. Remote push-button control.

1,488,473. AUTOMATIC CAR, TRAIN PIPE AND ELECTRIC COUPLER; T. R. Brown, Sparkill, N. Y. App. filed March 6, 1917.

1,488,474. MACHINE FOR MOLDING INSULATORS; J. A. Burns, Pittsburgh, Pa. App. filed Sept. 24, 1920. Whereby molds containing the plastic material may be intermittently and successively positioned.

1,488,480-1,488,481. REGENERATION OF ALKALINE STORAGE-BATTERY ELEMENTS; T. A. Edison, West Orange, N. J. App. filed Sept. 28, 1921. To regenerate the positive electrode elements.

1,488,483. ELECTRIC HEAT RADIATOR; J. A. Ellis and J. C. Vines, Sydney, New South Wales. App. filed Nov. 22, 1921. Concave-reflector type.

1,488,489. WAVE MODULATING; J. C. Gabriel, New York, N. Y. App. filed Dec. 23, 1920. For high-frequency transmission.

1,488,498. DYNAMO-ELECTRIC MACHINERY; E. B. Hoff, East Cleveland, Ohio. App. filed May 2, 1923. Terminal block for fractional-horsepower motors.

1,488,514. SELECTIVE AMPLIFYING APPARATUS; M. I. Pupin, Norfolk, Conn. App. filed Oct. 10, 1918. For electrical energy waves.

1,488,553. PROCESS OF COATING SHEET STEEL WITH ALUMINUM; S. Peacock, Wheeling, W. Va. App. filed Jan. 226, 1923.

1,488,556. ARRANGEMENT FOR RECOVERY OF ENERGY IN ELECTRIC RAILWAY SYSTEMS EMPLOYING SERIES-CONNECTED DIRECT-CURRENT MOTORS; E. Santuari, Milan, Italy.

1,488,560. ELECTROLYTIC CONDENSER; A. Slepian, Wilkinsburg, Pa. App. filed Dec. 30, 1919. Suitable for application in variable-voltage, alternating-current circuits.

1,488,569. COMBINED CAR, TRAIN-PIPE AND ELECTRIC COUPLER; W. V. Turner (deceased), late of Wilkinsburg, Pa. App. filed May 22, 1919.

1,488,570. ELECTRIC COUPLING FOR CARS; W. V. Turner (deceased), late of Wilkinsburg, Pa. App. filed May 22, 1919.

1,488,573, 1,488,574 and 1,488,575. CURRENT-COLLECTING DEVICE; C. F. Wagner, Pittsburgh, Pa. App. filed April 13, 1922. For equalizing or balancing the flow of current through the various brushes.

1,488,586. SENDERLESS AUTOMATIC TELEPHONE SATELLITE SYSTEM; G. Deakin, Antwerp, Belgium. App. filed Sept. 1, 1921. A manual main exchange and a subsidiary exchange with calls extended between the two by automatic switching mechanism.

1,488,598. TELEPHONE-EXCHANGE SYSTEM; C. L. Goodrum, New York, N. Y. App. filed Dec. 29, 1920. Machine switching.

1,488,607. TERMINAL HUB FOR THE BURNERS OF ELECTRIC RANGES; R. H. MacInnes, Hamilton, Ontario, Canada. App. filed Sept. 14, 1923.

1,488,613. VACUOUS ELECTRICAL APPARATUS; G. W. Pickard, Newton Center, Mass. App. filed Feb. 28, 1919. For preserving a vacuum without dependence upon a continuously operating vacuum pump.

1,488,619. COMMUTATOR FOR DYNAMO-ELECTRIC MACHINES; J. Schurch, Los Angeles, Cal. App. filed April 24, 1922. Axial length reduced.

1,488,621. ELECTRIC HAIR WAVER; R. P. Simmons, Cleveland, Ohio. App. filed July 30, 1923.

1,488,632. COVER FOR STORAGE-BATTERY CELLS; T. R. Cook, Pittsburgh, Pa. App. filed July 28, 1920. Made of hard rubber.

1,488,636. WIRE CONNECTOR; J. A. Geiser, Ferguson, Mo. App. filed May 24, 1920. For connecting insulated wires electrically without removing the insulation.

1,488,651. TROLLEY SYSTEM; J. Schumacher, Sr., Los Angeles, Cal. App. filed March 27, 1922. As used on cranes, etc.

1,488,658. CHANDELIER FIXTURE; J. Williamson, Chicago, Ill. App. filed July 14, 1922.

1,488,669. MOUNTING FOR ELECTRIC SWITCH AND PANEL BASES; B. E. Getchell, Plainville, Conn. App. filed March 8, 1920.

1,488,681. ELECTRIC RIVET HEATER; W. S Johnson and J. W. Shefer, Berwick, Pa App. filed Feb. 17, 1921.

1,488,690, 1,488,691. AUTOMATIC TELEPHONE EXCHANGE; F. A. Lundquist, Chicago, Ill. App. filed Oct. 12, 1917.

1,488,722. MAGNETO IGNITING DEVICE WITH REVOLVING FLUX CONDUCTOR; W. Walther, Stuttgart, Germany. App. filed Aug. 26, 1919.

1,488,723. STEERING GEAR; J. T. Welsh, Schenectady, N. Y. App. filed April 16, 1920. For ships.

1,488,731. CHECK PROTECTOR; G. W. Beebe, Albany, Ga. App. filed Sept. 11, 1916.

1,488,738. ELECTRIC BATTERY; T. R. Cook, Pittsburgh, and P. E. Norris, Wilkinsburg, Pa. App. filed Dec. 16, 1920. Storage type.

1,488,755. LUMINOUS ELECTRIC HEATER; F. Kuhn and J. A. Hand, Detroit, Mich. App. filed April 18, 1918. Concave-reflector type.

1,488,764. ELECTRIC HEATER; J. K. Northrop, Santa Barbara, Cal. App. filed Jan. 9, 1922. Immersion type.

1,488,774. ELECTROMAGNETIC STEP-BY-STEP MECHANISM; G. F. Atwood, Newark, N. J. App. filed Dec. 22, 1922. Employing a pawl and ratchet wheel.

1,488,784. 1,488,785. MEASURED-SERVICE TELEPHONE SYSTEM; C. L. Goodrum, New York, N. Y. App. filed April 23, 1920. For automatic exchanges.

1,488,786. MOTOR CONSTRUCTION FOR MECHANICAL HORNS; H. C. Grant, Bayonne, N. J. App. filed May 3, 1922.

1,488,788. ELECTRIC CURRENT-CONTROLLING DEVICE; J. F. Hearn, Passaic, N. J. App. filed Nov. 28, 1919. Selector switch for automatic telephone system.

1,488,789. METHOD OF AND APPARATUS FOR TRANSLATING SIGNAL VARIATIONS; C. Kinsley, New York, N. Y. App. filed March 29, 1920. In radio communication.

1,488,790. SPACE-TELEGRAPH AMPLIFYING AND RECORDING SYSTEM AND METHOD THEREFOR; C. Kinsley, New York, N. Y. App. filed March 29, 1920.

1,488,791. SPACE-TELEGRAPH RECEIVING SYSTEM; C. Kinsley, New York, N. Y. App. filed March 29, 1920.

1,488,797. MACHINE-SWITCHING TELEPHONE-EXCHANGE SYSTEM; L. Polinkowsky, Antwerp, Belgium. App. filed Feb. 24, 1919.

1,488,800. ELECTRIC CONTROL SYSTEM; H. M. Stoller and H. A. Pattison, New York, N. Y. App. filed March 28, 1921. For prime-mover dynamo plants employing an internal-combustion engine.